SYSTEM SPECIFICATION

FOR THE

GUNNERY AND TACTICAL ENGAGEMENT TRAINING SYSTEM

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Signature**:** ……
Date: 2013-03-27

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1 Scope

1.1 Identification

INFO This Specification applies to Gunnery and Tactical Engagement Training System, hereinafter referred to as ‘GTETS'.

1.2 System overview

INFO GTETS is a live training simulation system that will provide cost efficient gunnery training and realistic means for tactical training to the Swedish Armed Forces (SwAF).

INFO The Operational Concept Description (OCD) for GTETS [2] describes the current systems, background and history, introduces the needs that are leading to new requirements and outlines the new system.

INFO GTETS will be used in a variety of training exercises, ranging from individual and small unit gunnery training, to force on force tactical training in units from section up to battalion size. Tactical training exercises range from formal training to applied training with increasing realism, also facilitating “mission rehearsal” of planned live operations.

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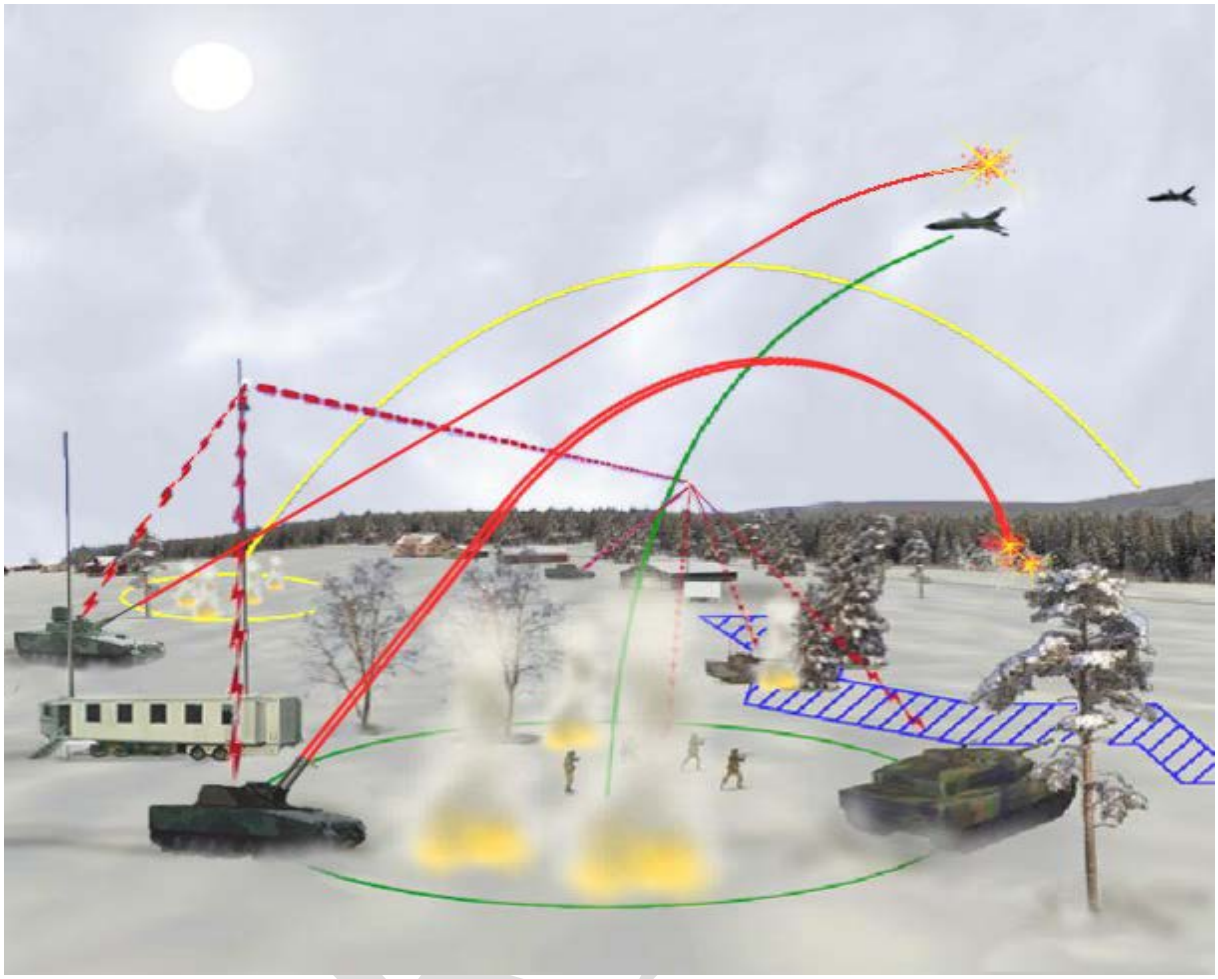

Figure 1. Conceptual overview of GTETS.

INFO GTETS will provide simulation of direct and indirect fire from various weapons, ranging from small arms to artillery pieces, as well as simulation of the effect of fire on Targets, including humans, vehicles and other objects. GTETS will also provide the capability to monitor and evaluate the simulated engagements and the effects of engagements. See Figure 2 for an overview of the main capabilities of GTETS.

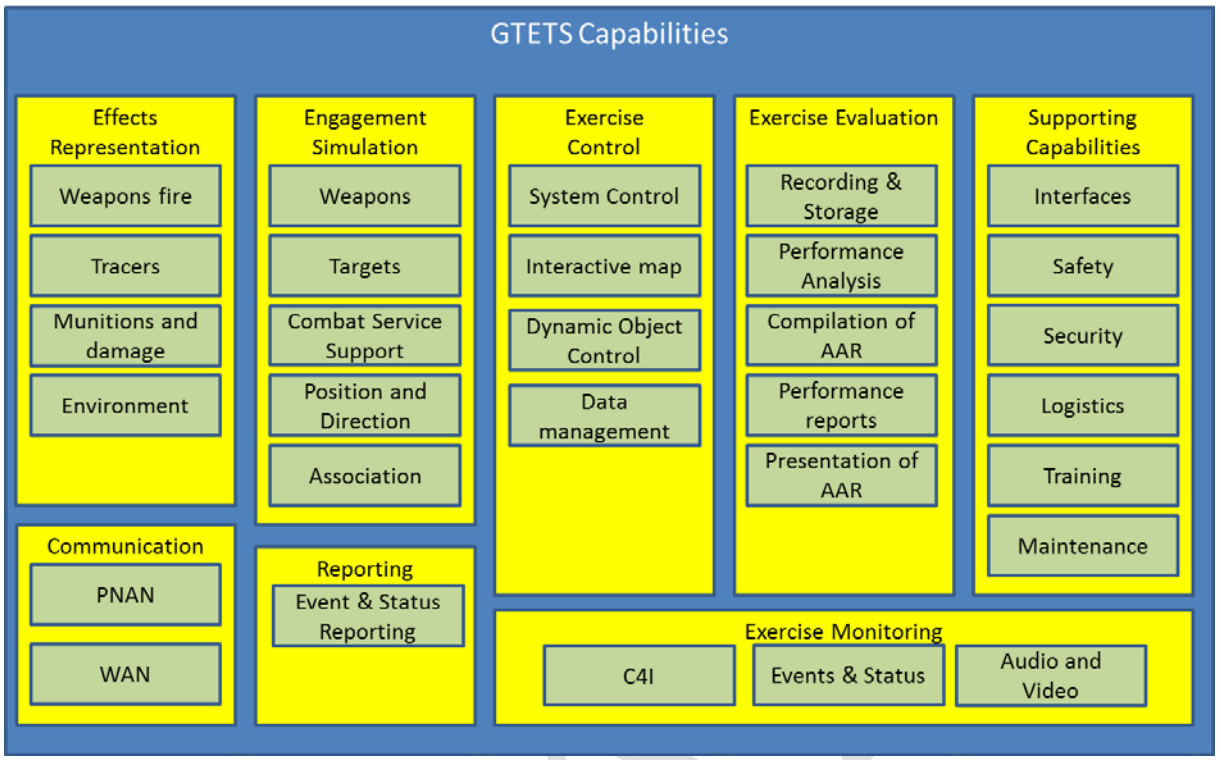

Figure 2: Overview of capability provided by GTETS.

INFO GTETS comprises several interoperable systems (hereinafter called ‘subsystems’). Each subsystem is independently replaceable for the purpose of future development, upgrade, and expansion. Some subsystems are existing (‘legacy’) systems that are currently in use in the Swedish Armed Forces and some subsystems are new systems that will replace obsolete technology and add new capabilities to GTETS. Figure 3 provides an overview of the GTETS subsystems.

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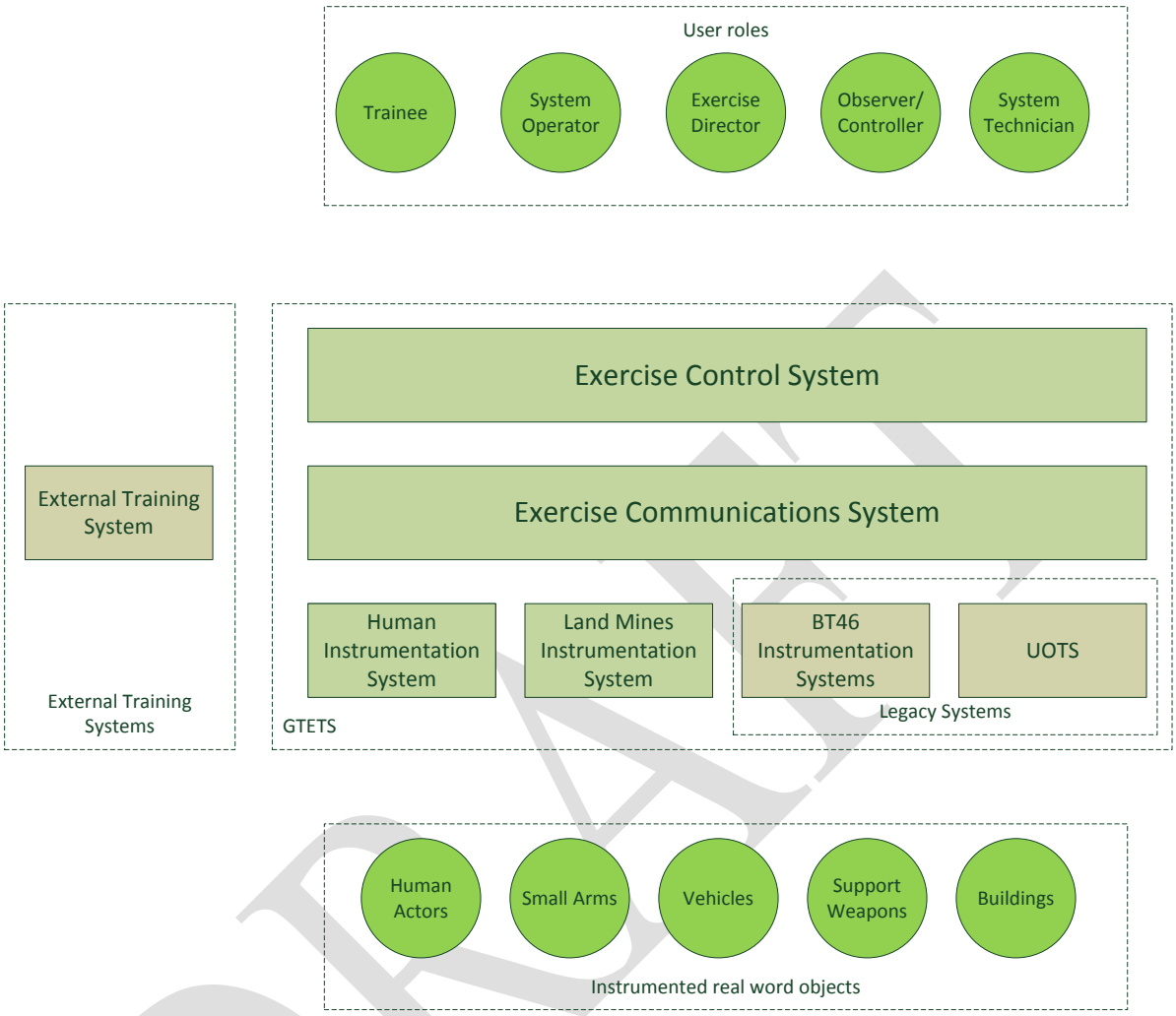

Figure 3: Overview of GTETS legacy and planned subsystems and operational context.

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1.3 Document overview

INFO The purpose of this Specification, including appendices, is to define the contractually binding requirements document toward which the final delivery verification of GTETS system and subsystems will be done.

INFO The intention of the requirements contained herein is to define the required capability at a level that provides a solid foundation for detailed design, thus allowing for design trade-offs, further exploration and optimisation by the Contractor. The intention is also to communicate previous design decisions that impose constraints on the system design to the Contractor.

INFO The structure and contents of this Specification is according to Data Item Description for System/Subsystem Specification which is part of MIL-STD 498 [1].

1.3.1 Reader's guidance

INFO Requirements are identified by a unique identification number. The same number scheme is used in the common System Specification and the different Subsystem Specifications.

INFO The requirement number scheme is:
<Prefix>"-"<sequence number>

INFO Prefix is defined as "SS" or "<Subsystem-acronym>". The first alternative is used for requirements in the System Specifications whereas the second alternative is used in subsystem specifications. "<Subsystem-acronym> is a short acronym for the subsystem as noted in the list of appendices.

INFO <sequence number> is unique within each specification document.

INFO Paragraphs without requirements identification are general information that aids in understanding the requirements. In addition to this information, references [2] and [3] provide background, rationale and information on the current system.

INFO Paragraphs with the form DEF <nn> are definitions that are referred to by requirements.

INFO The Operational Concept Description [2], the OCD, provides background information that aids in understanding this Specification. When references are made to information in the OCD from requirements in this Specification, the referred information is considered part of the requirement.

INFO This Specification introduces a set of subsystems, external interfaces and interfaces between subsystems. Requirements of subsystems are generally specified in Subsystem Specification or by reference to documentation of existing systems.

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INFO External interfaces identified in this document are normally allocated to a subsystem and specified in that subsystem specification or as references to public interface standards.

INFO Requirements that are common for several Subsystems are specified in this Specification. Those requirements may apply to all subsystems, only specific subsystems, or to another subset as stated in the respective paragraph.

INFO The main part of functional requirements are to be found in Section 3.2, however there are functional requirements to be found elsewhere in the document as well, e.g. there are logistics related functions found in Section 3.15 and user interface related requirements in Section 3.13.

INFO Whenever reference is made to a section or paragraph, the reference shall be interpreted to include all requirements and references in that section or paragraph.

1.4 Use of terms

INFO Certain words and phrases have a specific meaning in the context of this Specification. Some of these words and phrases are defined below. See Section 6 for explanations of acronyms and definitions used in this Specification.

INFO The word "shall" is used to express requirements.

INFO The word "should" is used to express optional requirements.

INFO The word "will" is used to express statements of fact and declaration of purpose on the part of FMV.

INFO Some requirements are written as a statement of need ending with the word ‘including’ and then followed by a list of particular characteristics, items, and parameters. In this context the word ‘include’ is used to point out considerations that are important to that specific need, but the meaning shall always be ‘including but not limited to’.

INFO Certain words and phrases have a specific meaning in the context of this Specification. Some of these words and phrases are defined below. See Section Notes for explanations of acronyms and definitions used.

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2 Referenced documents

No	Document no	Title	Date	Source
1.	MIL-STD 498	DID for System/subsystem specification	N/A	http://www.abelia.com/498pdf/SSS-DID.PDF
2.	10FMV6730-146:1	Operational Concept Description for Gunnery and Tactical Engagement Training System	2012	FMV
3.	VO Mark 37 179:27378/05	Systemspecifikation BT46	2005-04-26	FMV
4.	8890-068-037	Optical Interface specification OSAG. 2.0 Standard.	2011-11-10	https://osagstandard.com
5.	8890-080-004	OSAG. 2.0 Standard. Ammunition tables	2011-11-10	https://osagstandard.com
6.	2082442	Interface Design Document WLN Standard, Part 1	2011-11-10	https://osagstandard.com
7.	2086689	Interface Design Document WLN Standard, Part 2	2011-11-10	https://osagstandard.com
8.	IEEE 1516 (2010)	High Level Architecture	2010	IEEE
9.	RPR FOM v2.0 D17	Real-Time Platform Reference FOM	2003	SISO
10.	IEC 60529	Degrees of protection provided by enclosures (IP code).	2001-02-27	IEC
11.	EN 61 000-6-2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments		IEC
12.	EN 61 000-6-3	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments		IEC
13.	MIL-STD-461E	Requirements for the control of electromagnetic interference characteristics of subsystems and equipment		US DoD
14.	MIL-STD 810F	Test methods for determining the environmental effects on		US DoD

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		equipment		
15.	M7739-352031	Swedish Armed Forces' System Security Manual, H SystSäk E 2011 part 1, Common	2011	FMV. http://www.fmv.se/en/Our-activities/System-Safety/Handbooks-and-templates/Handbook-on-System-Safety/
16.	M7739-352032	[Swedish Armed Forces' System Security Manual, H SystSäk E 2011 part 2, Methods	2011	FMV. http://www.fmv.se/en/Our-activities/System-Safety/Handbooks-and-templates/Handbook-on-System-Safety/
17.	16 530:53625	The defence Sectors Criteria Document. Försvarssektorns Kriteriedokument – kemiska ämnen, kemiska produkter och varor.	2012-10-01	FMV. http://fmv.se/en/Our-activities/Environmental-work/Information-to-our-suppliers/The-defence-sectors-criteria-document/
18.	FSD 0246	Signs with bar code 3 of 9 (Code 39)	2010-05-11	FMV. http://fsd.smart-lab.se/fsd_online/pdf/english/0246e.pdf
19.	FSD 0182	Markings on outer packing (batch packing etc.)	1983-08-16	FMV. http://fsd.smart-lab.se/fsd_online/pdf/english/0182e.pdf
20.	M7762-000630	FMV Handbok materielpublikationer.		FMV. http://www.fmv.se/sv/Verksamhet/Teknisk-Information/Dokument-bibliotek/.
21.	M7762-000561	Handbok materielförteckningar.		FMV. http://www.fmv.se/sv/Verksamhet/Teknisk-Information/Dokument-bibliotek/.
22.	M7702-000181	Projekterings och installationsanvisningar för teleanläggningar		FMV. http://www.fmv.se/FTP/POINT/Meny.pdf.
23.	M7762-000861	Handbook HDB PROD MVSCH	2012-01-	FMV

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		VFM (English)	23	http://www.mvif-online.se/

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3 Requirements

INFO This Section contains requirements applicable to several subsystems are specified in this Specification. The requirements normally apply to all subsystems and equipment unless otherwise stated in the respective paragraph. Specific requirements on GTETS subsystems are defined in the respective subsystem specifications.

SS-1. Requirement
In case of contradictory requirements within specifications and between this System Specification and Subsystem specifications the following order of precedence shall apply;
a) Requirements defined in the respective Sub System Specification (SSS) shall have precedence over requirements in this Specification.
b) Functional requirements shall have precedence over design requirements.

INFO Requirements on the Exercise Communications System (ECS) are defined in Appendix 3, SSS Exercise Communications System.

INFO Requirements on the Exercise Control System (EXCON) are defined in Appendix 4, SSS Exercise Control System.

INFO Requirements on the Human Instrumentation System (HIS) are defined in Appendix 5, SSS HIS.

INFO Requirements on the Land Mines Instrumentation System (LMIS) are defined in Appendix 6, SSS LMIS.

3.1 Required states and modes

INFO The use of GTETS equipment is divided into separate MODES of operation for the purpose of structuring requirements that apply only to a certain MODE.

INFO In case a requirement applies only to a certain mode, this will be stated in the requirement.

3.1.1 Training modes

SS-2. Requirement
GTETS shall be designed for operation in the following modes, each mode providing functionality as defined by Section 3.2:
a) GUNNERY TRAINING MODE
b) TACTICAL TRAINING MODE

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c) LIVE FIRE TRAINING MODE

3.1.1.1 Gunnery training mode

INFO In GUNNERY TRAINING MODE, GTETS will be used as a cost effective way to conduct basic gunnery drills. In GUNNERY TRAINING MODE, the fidelity of certain simulations will reduced in order to conduct efficient repetitive training, for example simplified effects representation, infinite ammunition supply, fast reloading, and automatic recovery when hit. GTETS will provide direct feedback to Trainees to enable evaluation of hit performance without the need for instructors to be present.

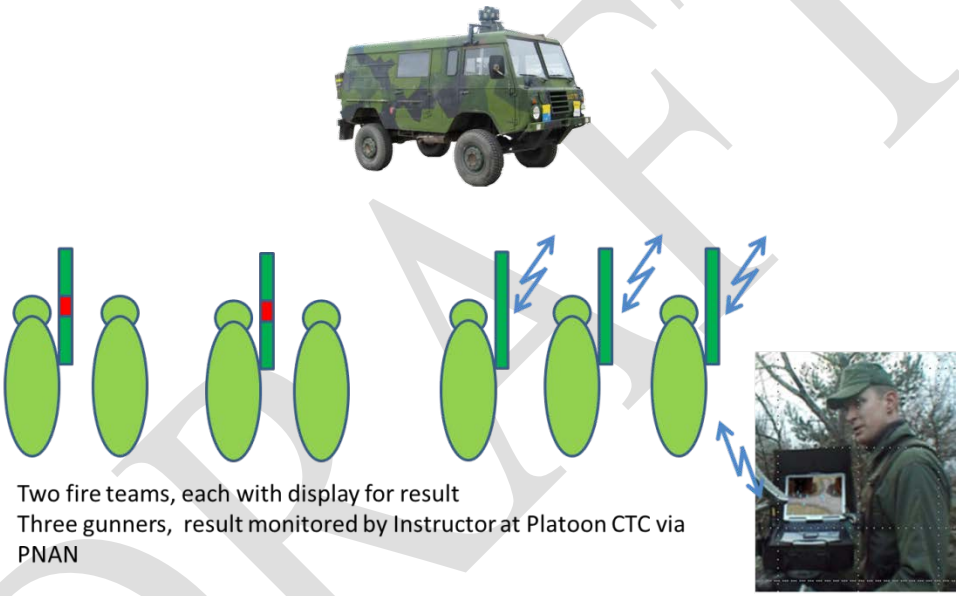

Figure 4. Example of gunnery training.

3.1.1.2 Tactical training mode

INFO In TACTICAL TRAINING MODE, GTETS will be used for force on force training of tactics and procedures in exercises ranging from section to battalion level. To provide correct basis for observation, decision making and actions in tactical training, GTETS will provide realistic cues and behaviour of simulated weapons and targets.

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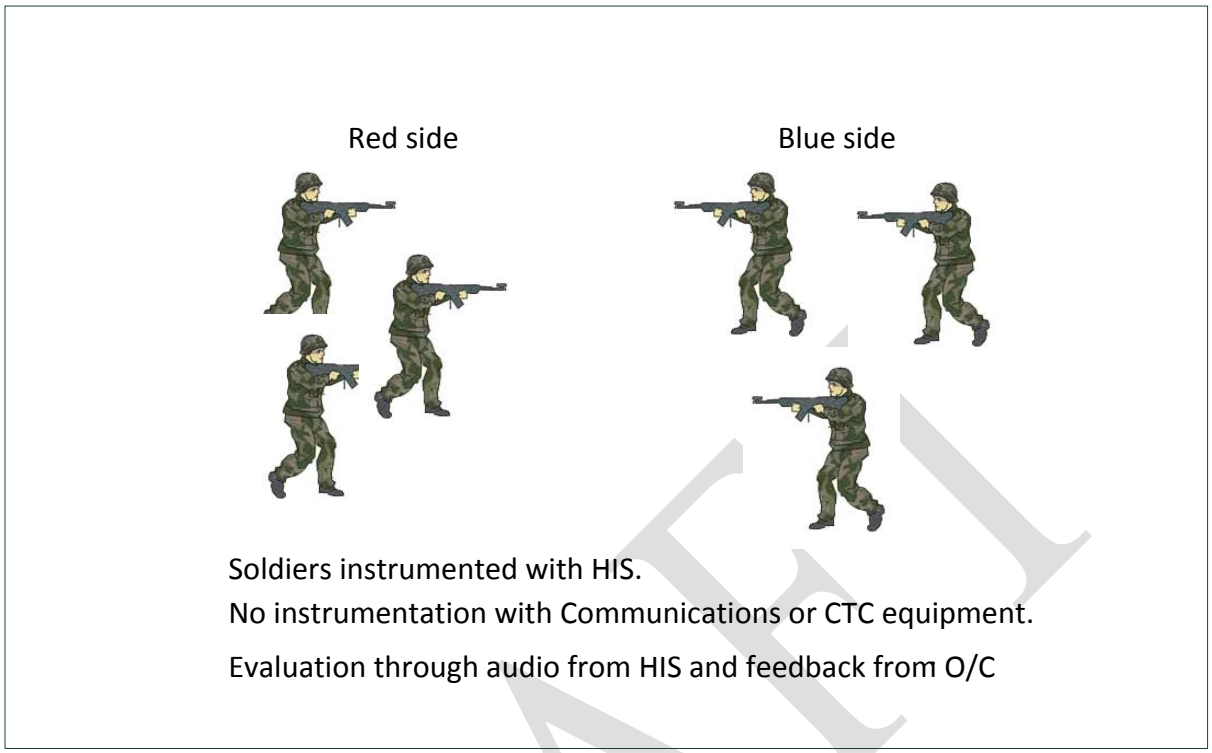
Red side
Blue side
Soldiers instrumented with HIS.
No instrumentation with Communications or CTC equipment.
Evaluation through audio from HIS and feedback from O/C

Figure 5. Example of tactical training without CTC and WAN.

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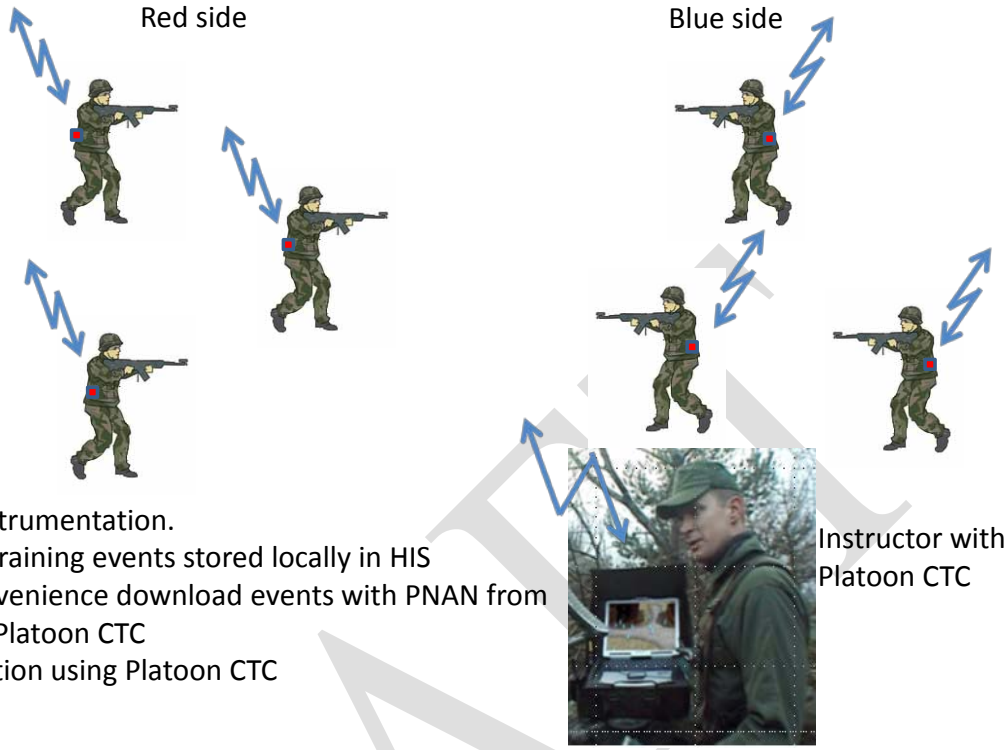
Red side
Blue side
No WAN instrumentation.
Registered training events stored locally in HIS
Time of convenience download events with PNAN from Trainees to Platoon CTC
AAR/Evaluation using Platoon CTC
Instructor with Platoon CTC

Figure 6. Example of tactical training with Platoon CTC without WAN connectivity.

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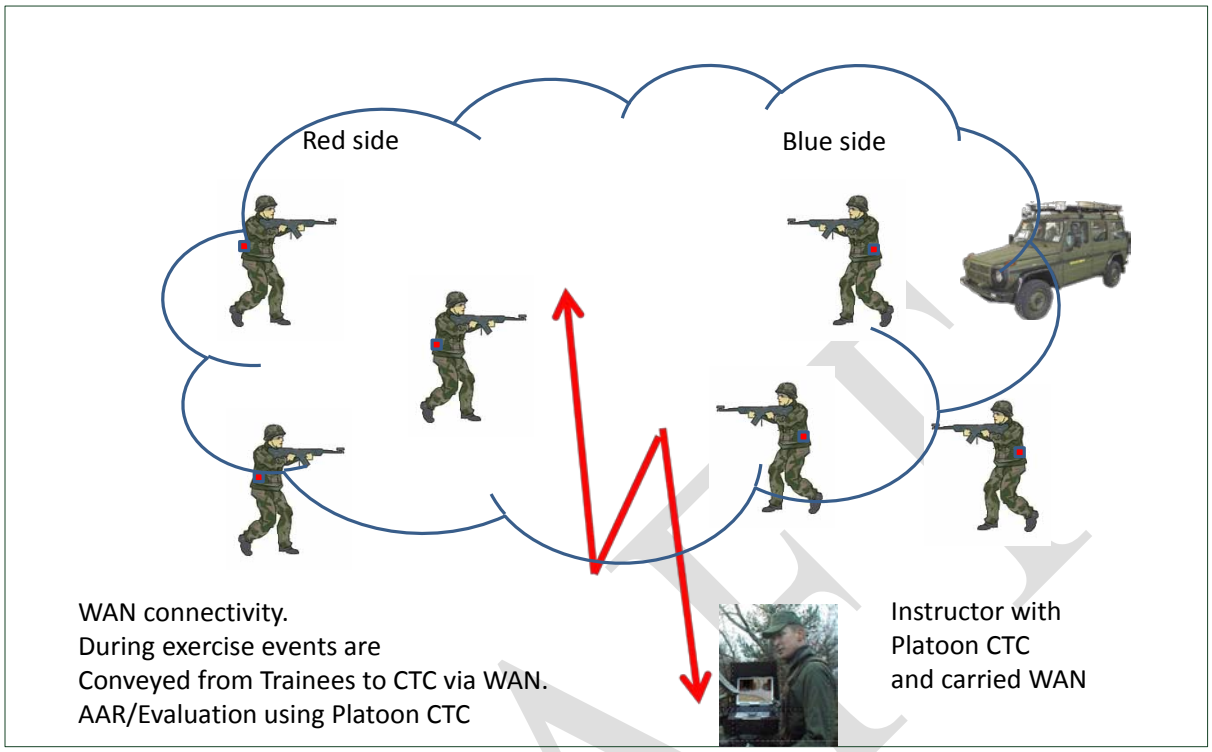

Figure 7. Example of tactical training with Platoon CTC and WAN connectivity.

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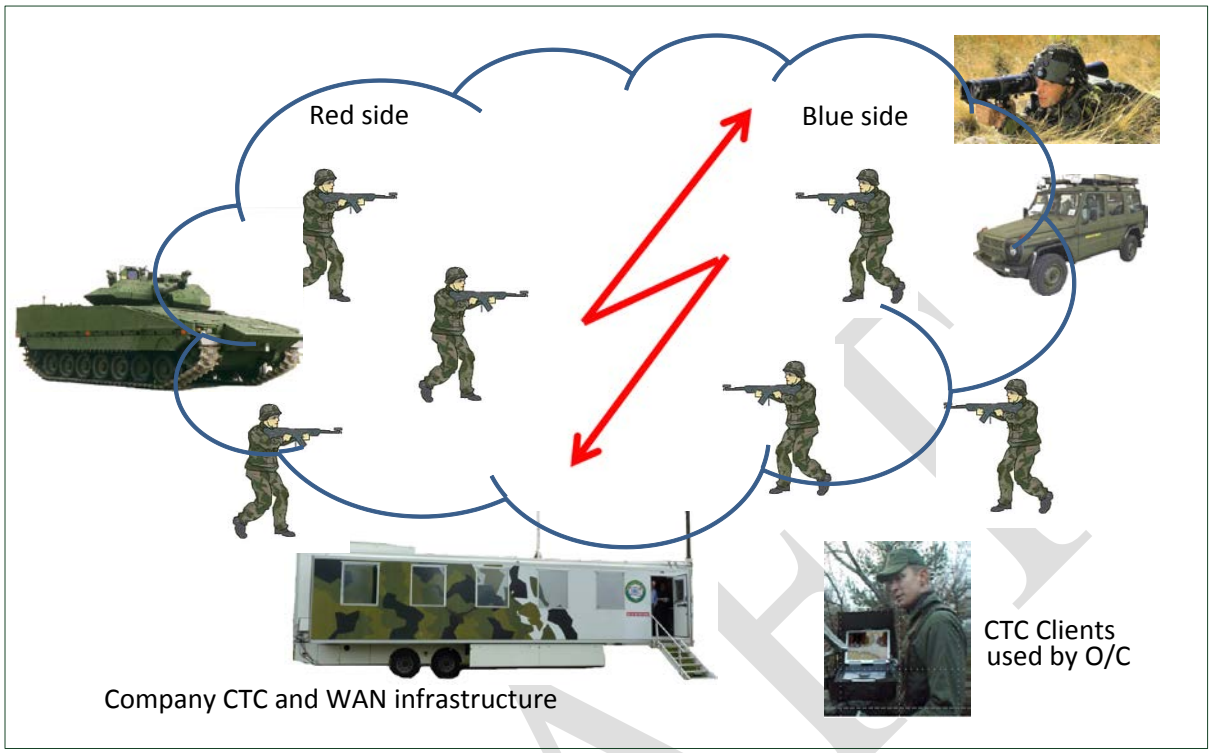

Figure 8. Example of tactical training with Company CTC.

3.1.1.3 Live fire training mode

INFO In LIVE FIRE TRAINING MODE, GTETS will be used for force on target training using live fire. Some of the GTETS capabilities can be used to support live firing. This applies in particular to monitoring the position and directions of actors and weapons, enabling comparison with danger zones and arcs of fire.

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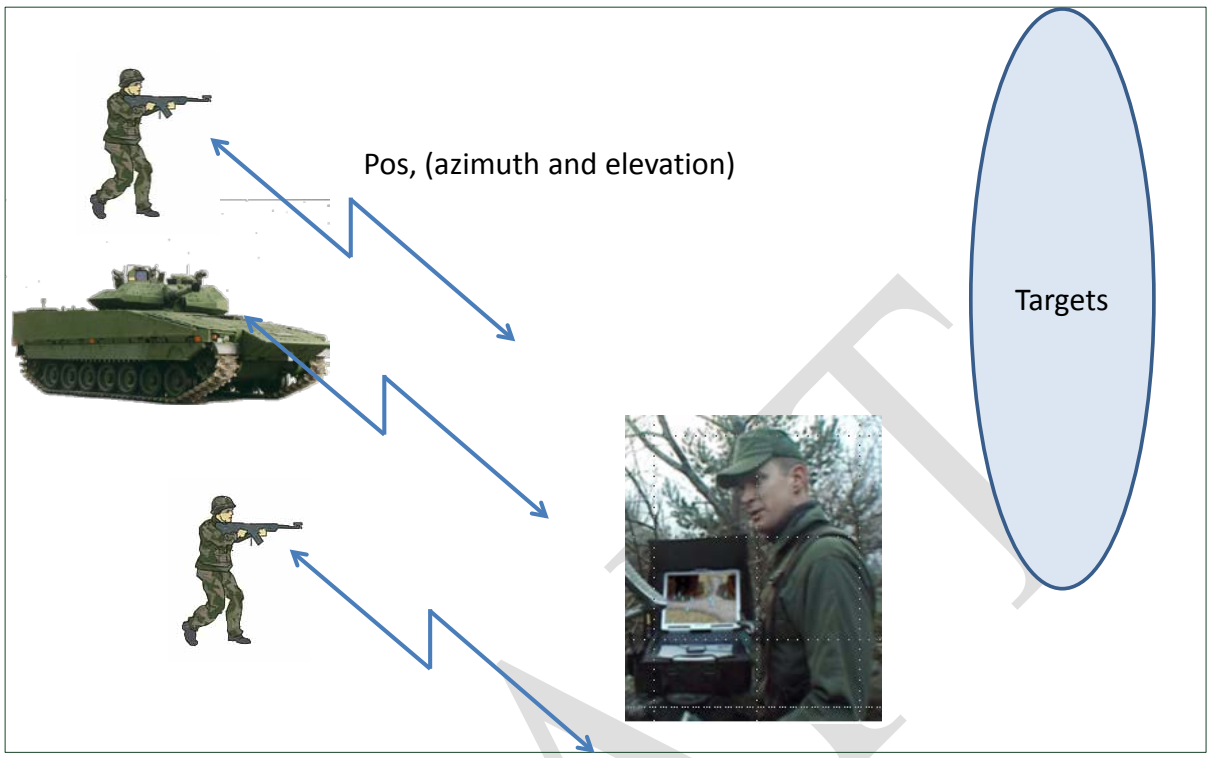

Figure 9. Example of live fire training.

INFO GTETS can also provide ‘target shoot back’; simulated fire against soldiers and vehicles participating in live firing exercises to increase the realism of the exercise.

3.2 System capability requirements

3.2.1 Operational capability

INFO GTETS equipment will be used in various combinations in exercises for different purposes. Typical exercises where GTETS equipment will be uses include gunnery training exercises, tactical training exercises, and live fire exercises.

INFO Gunnery training exercises will typically comprise up to 10 crew served weapons or 4 Combat Vehicles distributed over an exercise area 300 meters deep and 100 meter wide.

INFO When several exercises are conducted at the same time in the same geographical area the total number of vehicles and human Players is defining the size of one “equivalent exercise”.

INFO Platoon size tactical training exercises will typically comprise up to 60 human Players and 15 vehicles within a radius of up to 5 km.

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INFO Company size tactical training exercises will typically comprise up to 400 human Players and 20 vehicles within a radius of up to 10 km.

INFO Battalion size tactical training exercises will typically comprise up to 1200 human Players and 60 vehicles within a radius of 45 km.

INFO Battlegroup size tactical training exercise will typically comprise up to 2400 human Players and 150 vehicles within a radius of 45 km.

SS-3. **Requirement**
All GTETS equipment and components shall be compatible to form a fully integrated GTETS system.

SS-4. **Requirement**
GTETS shall enable the conduct at least four (4) concurrent and mutually independent Platoon size exercises within an area the size of a Company exercise.

SS-5. **Requirement**
GTETS shall be designed so that the capabilities of GTETS are possible to combine in various configurations that support varied training objectives, including the conduct of exercise in configurations Platoon, Company, Battalion, and Battlegroup according to definitions in this paragraph.

SS-6. **Requirement**
GTETS shall enable day and night operation.

SS-7. **Requirement**
GTETS shall be designed for operation within a radius of 6000 km from Brussels.

SS-8. **Requirement**
GTETS shall enable operation in built up areas, including inside and nearby buildings.

SS-9. **Requirement**
GTETS shall enable entry of Players into an exercise at any time before and during the exercise.

SS-10. **Requirement**
GTETS shall enable the exit of Players from an exercise at any time before and during the exercise.

SS-11. **Requirement**
GTETS shall enable authorised personnel to change side of Players at any time before and during an exercise.

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SS-12. Requirement
GTETS shall enable pausing of exercises in order to conduct briefings or evaluations and then resume training without any loss or change of data.

3.2.2 Engagement simulation capability

INFO This paragraph defines the common requirements on engagement simulation that are valid for all GTETS equipment and components. Refer to the respective subsystem specification for additional requirements pertaining to specific applications.

INFO GTETS provides simulation of the tactical engagement between live Players (Shooters and Targets) using real weapons and simulated fire. Engagements can however also take place between simulated Players and live targets. It is important that GTETS provide enough accuracy and realism to create confidence in the outcome of simulated engagements.

INFO Engagements, e.g. direct and indirect fire, is represented by the transfer of information between Shooter and Target, contained in the Fire record.

INFO The Fire record is a logical concept that for some engagement types is built up by a sequence of messages between Shooter and Target.

INFO The weapons simulation capability is associated with real or simulated weapons. Fire records from different weapons are conveyed by media suitable for that kind of weapon. For some weapons combination of media may be useful. Laser is the basic medium, but for an increasing number or weapons long or short range radio may be an alternative or complementing medium.

INFO The suitable medium or combination of media for the transfer of Fire records will be selected when designing the weapon instrumentation system. All Targets will be able to detect fire over all media.

INFO For some Shooter and Target combinations, a realistic simulation may require a combination of Fire records over different media.

SS-13. Requirement (optional)
When receiving Fire records via laser, PNAN, and WAN, Targets should automatically determine whether or not Fire records represent the same engagement.

SS-14. Requirement (optional)
Targets should be capable of using several Fire records representing the same engagement when determining effect of the engagement.

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3.2.2.1 Laser engagement

INFO Laser engagement is possible when the weapon is instrumented with a laser transmitter. Laser engagement can be used against Targets instrumented with detectors and reflectors. Two-way ballistic simulation is normally used, however one-way laser is allowed in some cases, e.g. for small arms.

SS-15. Requirement
Laser engagements in GTETS shall be possible at ranges of at least 3000 meters, assuming atmospheric transmission exceeds 0.3 at 900 nm, unless otherwise specified in the respective subsystem specification.

SS-16. Requirement
Shooters and Targets shall be capable of two-way ballistic simulation of direct fire engagements via Interface A, unless otherwise specified in the respective subsystem specification.

SS-17. Requirement
GTETS shall enable System Technicians to configure which coding (OSAG or FMV) of Fire records that is used in an exercise.

SS-18. Requirement
When set up for using FMV code, Shooters shall be capable of engaging the existing BT46 applications, including those listed in Appendix A, via Interface A.

SS-19. Requirement
When set up for using FMV code, Targets shall be capable of being engaged by the existing BT46 applications, including those listed in Appendix A, via Interface A.

SS-20. Requirement (optional)
GTETS should enable use of FMV coding and OSAG 2.0 coding in parallel in the same exercise as defined by Interface A.

SS-21. Requirement (optional)
Shooters and Targets should be capable of selecting coding (OSAG or FMV) for a specific exercise based on status updates received via Interface B and Interface C.

3.2.2.2 Non-laser engagement

INFO Fire represented by Fire record over non-laser media, such as WAN and PNAN is suitable for engagements where optical line of sight is not feasible between shooter and Target.

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SS-22. Requirement
For engagement simulations via Interface B or C, the contents and structure of Fire records shall be in accordance with the laser coding used in the exercise.

SS-23. Requirement (optional)
Fire records representing non-laser engagements should contain information defining the trajectory and geographical area affected by the engagement.

3.2.2.2.1 WAN engagement

INFO Wide Area Network (WAN) is a suitable medium for indirect fire, weapons that have an area effect, and fire on ranges beyond that of laser range.

INFO When instrumented weapons are using WAN engagement, the shooter will calculate coordinates for the trajectory and impact point or area.

INFO Fire records sent over WAN may be broadcasted to Targets in a larger area than where the fire has effect. The area where the fire has effect is in this case included in the Fire record.

SS-24. Requirement
When connected to WAN, the Target shall be capable of receiving Fire records via WAN.

SS-25. Requirement (optional)
When receiving a broadcasted Fire record over WAN, the Target should be capable of determining whether each received Fire record is applicable to the Target or not.

3.2.2.2.2 PNAN engagement

INFO The PNAN short range radio is suitable for weapons with effect in a limited area around an explosion point like mines, IED, hand grenades, secondary damages etc.

INFO The maximum area size is the reach of the PNAN.

INFO Probable damage is often reversed proportional to the distance between the impact point and the Target position.

SS-26. Requirement
All Targets shall be capable of receiving broadcasted Fire records via PNAN.

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3.2.2.3 Weapon simulation

SS-27. Requirement
GTETS weapon instrumentation systems shall start engagement simulation when detecting that the weapon is fired.

SS-28. Requirement
Simulated fire shall, provided that aiming and firing is done in accordance with the regulations for the real weapon, and that the aim point is within the physical limits of the Target, result in hitting the Target unless otherwise specified in the respective sub-system specification.

SS-29. Requirement
The accuracy of weapons fire simulated by GTETS shall be affected by the actions to compensate for external factors taken by the operator. This requirement applies to weapons where compensation for external factors such as wind, temperature, and powder temperature can be used in the ballistics calculation.

SS-30. Requirement
GTETS shall require the operator to take appropriate actions, similar to the actions needed in real use, to correct a simulated malfunction before simulated fire can be enabled.

SS-31. Requirement
Simulated fire shall be prevented during simulated reloading.

SS-32. Requirement
In TACTICAL TRAINING MODE, the time required for simulated reloading shall be consistent with the average reloading time of the real weapon.

SS-33. Requirement
In GUNNERY TRAINING MODE, simulated fire with unlimited ammunition supply shall be enabled by GTETS.

SS-34. Requirement
A weapon that is associated to a human Player shall be prevented from firing simulated fire when the damage status of the human Player is any one of the following:
a) In Shock
b) Wounded
c) Killed

SS-35. Requirement
A combat vehicle weapon shall be prevented from firing simulated fire when the damage status of the combat vehicle is any one of the following:

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a) In Shock
b) Weapon Damage
c) Total Kill

SS-36. Requirement
The accuracy of impact coordinates and trajectory for indirect fire projectiles calculated by GTETS shall be similar to the accuracy of the real weapon when using live ammunition.

SS-37. Requirement
Commenced simulated firing shall be terminated in a realistic way when the damage status of a Player is changed to any of the following:
a) In Shock
b) Weapon Damage/Wounded
c) Killed/Total Kill

SS-38. Requirement (optional)
Accurate simulation of direct fire should be possible when the optical line of sight between Shooter and Target is obscured.

SS-39. Requirement (optional)
Operator actions required to make the weapon ready for fire, including actions to load, before enabling simulated fire should be the same as for the real weapon.

SS-40. Requirement (optional)
Erroneous target tracking should have the similar simulated consequences as in operational firing regarding e.g. auto destruction of missiles.

SS-41. Requirement (optional)
GTETS should be able to simulate malfunctions of weapons that influence the engagement procedure.

3.2.2.4 Target simulation

INFO The target simulation capability determines damages caused by fire that is detected by any of the simulated fire methods.

INFO Targets are defined as dynamic objects capable of receiving Fire records, and include the following types of dynamic objects:
a) Human Players
b) Vehicles
c) Buildings

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SS-42. Requirement
In LIVE FIRE TRAINING MODE, the GTETS shall provide the option to use the capability defined in Paragraph 3.2.2.4 Target simulation for Players while the Player is firing live ammunition.

SS-43. Requirement
In GUNNERY TRANING MODE, the GTETS shall provide the option to conduct two-way laser engagements towards Targets equipped only with retro reflectors.

3.2.2.4.1 Target template

SS-44. Requirement
GTETS shall provide a Target template for each Target that enables the Target to determine the damage resulting from simulated engagements, taking the impact point in relation to the Targets geometrical shape and the vulnerability for each ammunition type at the point of impact into account.

SS-45. Requirement
The Target template shall enable simulated fire representing contact fuse, delayed fuse, proximity fuse and time fuse munitions.

SS-46. Requirement
The Target template shall enable Shooters to employ targeting techniques where contact fuse munitions are fired nearby structures for the purpose of detonating near the Target. Examples include hitting the ground with HE projectile in front of and beside the Target, hitting trees above and behind the Target.

INFO It is important that Trainees are rewarded for using surrounding terrain, buildings or other structures as cover to minimize the part of the Player that is exposed to fire.

SS-47. Requirement (optional)

The Target template should automatically be adjusted to compensate for the additional protection achieved when the Player uses terrain and obstacles for cover. INFO
It is important that Trainees are rewarded for using protective equipment to minimize the effects of fire that the Player is affected by.

SS-48. Requirement (optional)
The Target template should be possible to adjust to compensate for additional protection equipment used by the Player.

INFO It is important that Trainees cannot feel safe from fire behind thin, non-protective obstacles.

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SS-49. **Requirement (optional)**
The calculation of damaging effect behind obstacles should take into account the effect of ammunition used in relation to the protective characteristics of the obstacle.

3.2.2.4.2 Damage evaluation

INFO The capability of Targets to detect simulated fire is defined in the respective subsystem specification.

SS-50. **Requirement**
When receiving a Fire record, Targets shall determine the result of the engagement to be one of the following:
a) Miss
b) Near miss
c) Hit

SS-51. **Requirement**
Targets shall determine the damage after receiving a Fire record, taking the following factors into account:
a) Vulnerability to the used ammunition
b) Range between Shooter and Target (for kinetic energy weapons)
c) Impact aspect angles
d) Location of impact
e) Target template

SS-52. **Requirement**
The result from damage calculation shall be presented to the Player within 1 sec from receiving Fire record.

SS-53. **Requirement**
The simulated damage for vehicles resulting from the damage calculation shall depict the corresponding real world event through one of the following:
a) Fully Operational
b) In Shock
c) Movement Damage
d) Weapon Damage
e) Communication Damage
f) Total Kill

SS-54. **Requirement**
The simulated damage for buildings or parts of buildings resulting from the damage calculation shall depict the corresponding real world event through one of the following:

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a) Fully Operational
b) Breach hole
c) Destroyed

SS-55. **Requirement**
The damage status of buildings shall be applied to affected construction element (wall, room, floor, entire building) of the building considering the used ammunition, the hit location and the construction of the building.

SS-56. **Requirement**
Damage Status “In Shock” shall automatically be changed to “Fully Operational” after a random period of time between, by default between 5-30 seconds.

SS-57. **Requirement**
Players with damage status In Shock, Wounded or Damaged shall be prevented from participating in action in accordance with the damages. See the respective SSS for detailed requirements.

SS-58. **Requirement**
In case Players act outside of restrictions implied by the Player’s simulated damage, the Player’s damage status shall be changed to killed/total kill. For example: moving (other than what is required by traffic safety) a vehicle with status ‘mobility kill’.

SS-59. **Requirement (optional)**
Repeated hits should cause accumulated damage effects on Targets.

INFO It is important that Players are rewarded by proper use of close range protection smoke. Operational close range protection smoke may normally not be used during training due to safety reasons. Training smoke that is allowed may need special techniques to simulate the effect of the operational smoke.

SS-60. **Requirement (optional)**
Activation of simulated close range protection smoke should decrease the probability hit by direct fire that is fired after smoke is activated.

SS-61. **Requirement (optional)**
The shielding effect of close range smoke should decrease as a function of outdoor temperature, wind speed, wind direction, and elapsed time between the activation of smoke and the direct fire event.

INFO It is important that Players understand the dangers of unintentional damage caused by weapons.

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SS-62. **Requirement**
Players that are located inside a Target (incl. buildings and vehicles) that is hit by simulated fire shall receive Fire records for secondary effects to an extent that is similar to the corresponding real world event.

SS-63. **Requirement (optional)**
Players that are located near a Target (incl. building and vehicle) that is hit by simulated fire should receive Fire records for secondary effects to an extent that is similar to the corresponding real world event.

SS-64. **Requirement (optional)**
Weapons with danger zone for muzzle blast should when fired send Fire records affecting Players in the danger zone for muzzle blast.

SS-65. **Requirement (optional)**
Weapons with danger zone for back blast should when fired send Fire records affecting Players in the danger zone for back blast.

SS-66. **Requirement (optional)**
GTETS instrumentation systems should simulate other secondary effects of fire, e.g. Targets that are burning shall affect nearby Targets.

3.2.2.5 Combat service support simulation

INFO The simulation of firing and damage caused by fire should be complemented with presenting logistic effects of the simulated engagement and means for the trained troop to increase their success probability by performing proper logistic actions that can be noted by the GTETS system.

INFO The damage status of a Player needs to be visualised so that the information can be used as the base for actions to repair/treat the damage/wound.

3.2.2.5.1 Medical care

INFO Medical Care is applied only to Human Players. Functional requirements related to Medical Care are referred to Appendix 5, SSS HIS.

3.2.2.5.2 Recovery and repair

INFO Vehicle Recovery and Repair is applied to Vehicles, see the respective Subsystem Specification for additional requirements.

INFO GTETS will be used to train recovery and repair chain, from initial actions by the crew to actions at rear repair units.

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SS-67. **Requirement**
Repair actions shall be reported by the instrumented object in event reports.

SS-68. **Requirement**
Simulated repair shall require a realistic amount of time.

SS-69. **Requirement (optional)**
Targets should be capable of visual presentation of the nature of the damage to participants in the exercise.

SS-70. **Requirement (optional)**
Targets should provide means to enable Trainees to repair simulated damage according to the corresponding damage description.

SS-71. **Requirement (optional)**
Simulated damages that are not repaired should gradually reach more severe status.

3.2.2.5.3 Ammunition and supply

INFO Ammunition Supply applies to all types of Weapons.

INFO For some weapons firing a blank is needed to initiate simulated engagement. In this case the handling of supply of blanks creates a natural need for training the supply chain for ammunition.

INFO For other weapons there is a need to simulate the ammunition supply levels and the supply actions.

INFO Common requirements are specified here. Specialisation and addition of requirements are given in relevant Subsystem Specifications.

SS-72. **Requirement**
In TACTICAL TRAINING MODE, the amount of simulated ammunition available to the Player shall by default be set to prescribed level (Swedish: RU) at exercise start.

SS-73. **Requirement**
In TACTICAL TRAINING MODE the simulated ammunition consumption and ammunition storage capacity of weapons shall be in accordance with the real equipment.

SS-74. **Requirement**
GTETS shall enable ammunition resupply actions performed by Players to be registered in EXCON.

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SS-75. **Requirement**
The time needed for simulated ammunition resupply and simulated ammunition redistribution shall be similar to the time needed for the corresponding real world event.

SS-76. **Requirement (optional)**
Instrumentation systems should enable Players to redistribute ammunition between Players during an exercise.

SS-77. **Requirement (optional)**
Instrumented objects should be capable of receiving updates of supply level status via Interface B and Interface C.

SS-78. **Requirement (optional)**
GTETS should enable Players to report real supply actions, including resupply of fuel and water to EXCON.

3.2.2.5.4 Combat engineering

SS-79. **Requirement (optional)**
GTETS should provide the option for Players to report simulated field engineering work to EXCON.

3.2.2.6 Position and direction

SS-80. **Requirement**
GTETS shall provide the capability for each Player to automatically determine its own position with accuracy as defined in this Specification.

SS-81. **Requirement (mandatory)**
Positioning equipment for Players provided by GTETS shall determine the Player's position outdoors with static and dynamic accuracy that is better than 3 meters horizontally and vertically during 95% of the time.

SS-82. **Requirement (optional)**
Positioning equipment for Players provided by GTETS should determine the Players position outdoors with static and dynamic accuracy that is better than 1 meter horizontally and vertically during 95% of the time.

INFO There is a need to measure azimuth directions and elevation for ballistic weapons for different reasons. In TACTICAL TRANING MODE some weapons may need it to calculate impact area for simulated fire. In LIVE FIRE TRAINING MODE directions need to be monitored towards allowed danger zones for the exercise.

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SS-83. **Requirement (optional)**
Players should continuously measure and store horizontal and vertical position, as well as the azimuth direction and elevation of the weapon.

SS-84. **Requirement (optional)**
Measurements of azimuth direction and elevation for ballistic weapons should be accurate enough to predict the area of impact with the same accuracy as the practical real world accuracy of the specific weapon.

SS-85. **Requirement (optional)**
In LIVE FIRE TRAINING MODE, GTETS should provide the option to use functions for position and direction monitoring of the Players weapons while firing live ammunition.

3.2.2.7 Association

INFO In the context of this Specification, the term association means the linkage between dynamic objects id for the purpose of exercise evaluation and enabling that the Player´s status has an impact on the usage of associated equipment.

INFO Requirements on associations of Human Players to buildings and vehicles are specified in Appendix 5, SSS HIS.

SS-86. **Requirement**
Association between two instrumented objects shall require no more than 12 seconds to be established, unless otherwise specified in the respective SSS.

SS-87. **Requirement (optional)**
Association between two instrumented objects should require no more than 6 seconds to be established, unless otherwise specified in the respective SSS.

3.2.2.7.1 Vehicle and Human Player association

SS-88. **Requirement**
Vehicles shall automatically detect and keep track of Human Players that are located inside the vehicle.

SS-89. **Requirement (optional)**
Vehicles should be capable of determining if Players via PNAN are located inside or outside the vehicle.

3.2.2.7.2 Equipment association

INFO In this context equipment is weapons and any gear that may affect the outcome of simulated engagement or logistic actions and that GTETS is capable of

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recognizing. Equipment can be handed between Players so it is necessary to keep track of who is in possession of what equipment end where the equipment is.

INFO Requirements on associations between Human Players and their equipment are specified in the Appendix 5, SSS HIS.

SS-90. Requirement (optional)
Vehicles should automatically detect and keep track of GTETS instrumented equipment that is located inside the vehicle.

SS-91. Requirement (optional)
Buildings should automatically detect and keep track of GTETS instrumented equipment that is located inside the building.

3.2.3 Effects representation capability

INFO The purpose of the effects representation capability is to enhance the training by providing a realistic and immersive representation of an actual combat environment. Realistic battlefield cues will be used in exercises in order to trigger actions and behaviours, support situational awareness, provide feedback to actions, and provide a basis for decision making in complex situations. To reach adequate training goals of tactical training it is essential that several effects of fire are represented in a realistic way for different audience. Environmental effect representations will be used to create frictions and to increase the feeling of being immersed into an actual area of operations.

INFO Effects that are important for training include:
- Firing of a weapons
- Trajectories of projectiles (bullets, grenades, missiles)
- Impacts of munitions (bullets, grenades, missiles, etc.)
- Environmental events and activity, like wildfires, heavy smoke etc.

INFO Effect representations are important cues for decision making .Thus, it is important that effects contain neither more nor less information that would be provided by the real world event. An example: For soldiers training target prioritisation (e.g. to fire on a target until destroyed before switching to next target), the use of effects employing simple colours schemes to indicate discrete damage states may over-simplify the decision making process, and thus cause negative training.

SS-92. Requirement
Effect representations shall be limited to the information that would be likely to observe in a corresponding actual live firing situation.

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SS-93. **Requirement**
Vehicles shall be able to represent effects for crew and passengers as audio messages sent over internal communication system.

SS-94. **Requirement**
In TACTICAL TRAINING MODE realistic effects representation for weapons fire and munitions hit as defined in 3.2.3.1 and 3.2.3.2 shall be provided by GTETS.

SS-95. **Requirement**
In GUNNERY TRANING MODE the option to conduct gunnery training without the realistic effect representations that are defined in 3.2.3.1 and 3.2.3.2 shall be provided by GTETS.

3.2.3.1 Weapons fire representation

SS-96. **Requirement**
In TACTICAL TRAINING MODE, GTETS shall provide audio and visual representation of weapon fire similar to the audio and visual signature of the actual weapons fire, and that can be perceived by Trainees day and night within a realistic distance from the weapon.

SS-97. **Requirement**
GTETS shall provide audio and visual representation of actions related to the operation of weapons via internal communication that would be perceived by the operator and potential other members of the crew of the weapon/vehicle in the corresponding real world situation. This includes in particular, loading, mechanism, and triggering sounds.

SS-98. **Requirement**
GTETS shall provide visual representation of tracer ammunition trajectories to the gunner.

SS-99. **Requirement (optional)**
GTETS should provide visual representation of tracer ammunition trajectories to the Shooter and observers in the vicinity of the fire through e.g. sights and observation tools.

3.2.3.2 Munitions hit representation

SS-100. **Requirement**
GTETS shall provide visual representation of munitions hits that can be perceived by Trainees day and night within at a realistic distance from the Target.

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SS-101. **Requirement**
The position of impact of indirect fire in the target area shall be represented for forward observer allowing fire adjusting commands.

SS-102. **Requirement**
Impact of fire when hitting, or exploding close to, a Target vehicle shall be represented for the crew of the Target vehicle.

SS-103. **Requirement**
Impact of fire hitting an already hit target shall be represented.

SS-104. **Requirement**
GTETS shall be capable of presenting effects so that Players in or close to buildings and vehicles can understand that they are under fire.

SS-105. **Requirement (optional)**
The location of munitions hit effects in relation to the hit point should be accurate to an extent that enables fire adjustments, fire distribution, and fire control using the same methods and procedures as for the corresponding real weapon.

SS-106. **Requirement (optional)**
GTETS should be able to visually represent close range protection smoke fired by vehicles.

SS-107. **Requirement (optional)**
Impact of fire in the target area should be represented in sights and observation tools for the Shooter and observers that are in the vicinity of the impact area.

SS-108. **Requirement (optional)**
Impacts of fire in the target area should be depicted for the Shooter as soil eruptions or water eruptions (Swedish: “uppkast”) in sights and goggles.

SS-109. **Requirement (optional)**
GTETS should provide means for instrumenting buildings so that effects of fire and field engineering can open holes in walls and roofs allowing human Players to enter.

3.2.4 Reporting capability

INFO Reports of events, for example engagement results and changes of Player status (including damage status, supply status), will be used by EXCON for the purpose of monitoring and evaluation of exercises. Normally, reports are sent by each Player via carried WAN equipment to EXCON. However, when WAN is not available, the transfer of event data will be achieved via other means of communication, for example via PNAN to portable EXCON.

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3.2.4.1 Events reporting

SS-110. Requirement
Players shall automatically report events that pertain to status and interactions of the Player, including but not limited to the following events (as applicable to the specific type of Player):
a) Engagement (Fire Report)
b) Status change
c) Association change

SS-111. Requirement
Each event report shall contain the following data:
a) Unique identity of the Player
b) Time when the event occurred
c) Position of the Player when the event occurred

SS-112. Requirement
Each Fire Report shall at least contain the following data:
a) Firing Weapon ID
b) Ammunition Code

SS-113. Requirement (optional)
Each Fire Report should contain data allowing the calculation of the following:
a) Time of impact
b) Distance to Target
c) Weapon azimuth and elevation
d) Remaining ammunition
e) Hit information

SS-114. Requirement
When connected to WAN, Players shall report events to EXCON via Interface F (WAN).

SS-115. Requirement
Event data reported via WAN shall be presented in EXCON within 3 seconds after the event occurred.

SS-116. Requirement
When not connected to WAN, Players shall report events to EXCON in one of the following ways:
a) Directly to associated EXCON via Interface B (PNAN)
b) To an associated Player via Interface B (PNAN) for relay to EXCON

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SS-117. Requirement
Dynamic Objects, other than Players, shall report events to EXCON via available communications.

3.2.4.2 Events recording and storage

SS-118. Player event recording
Players shall automatically record events that occur during periods of interrupted communication and store them locally.

SS-119. Requirement
Players shall be capable of storing event data generated during three (3) hours of exercise locally.

SS-120. Requirement
Recorded events that are stored locally by Players shall be possible to retain after power off and battery change.

SS-121. Requirement
Players shall automatically report all stored events as soon as possible when communication is restored after a period of interrupted communication.

3.2.4.3 Position and orientation reporting

SS-122. Requirement
All Players shall report their own position to EXCON with a frequency that enables presentation of the Players position within the accuracy specified in 3.2.2.6 Position and direction.

INFO For requirements on position reporting via the carried WAN-equipment, see Appendix 3; SSS ECS.

INFO Players not equipped with WAN and Players that are temporarily without WAN-connection shall be able to report position over PNAN to either a nearby portable EXCON or via a nearby WAN-capable Player.

SS-123. Requirement
For human Players, the resolution and accuracy of the reported position data shall enable differentiation of individual human Players in typical infantry formations used during combat.

SS-124. Requirement
Position reporting shall only take place when the Player has actually moved.

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SS-125. **Requirement**
Position reports shall include the estimated current radial error, as determined by the positioning equipment.

SS-126. **Requirement**
Position reporting interval shall be adjusted to the speed of the Player so that specified accuracy and resolution of reported position data is maintained at all times (e.g. high speed → longer distance travelled between reports → more frequent reports).

SS-127. **Requirement**
Players shall be able to report own direction (azimuth) data as defined in 3.2.2.6 Position and direction.

SS-128. **Requirement**
Players shall be able to report azimuth and elevation data of used weapons as defined in 3.2.2.6 Position and direction.

SS-129. **Requirement**
When Player is in scope of indoor positioning equipment RAD, the Player shall include the RAD information in the reported position.

3.2.5 Communication capability

3.2.5.1 Wide Area Network

INFO The Wide Area Network (WAN) primarily facilitates communication between Players and EXCON. Direct communication between Players should also be possible.

INFO Communication from Players to EXCON includes position reports, event reports, and Fire records.

INFO Communication from EXCON to Players includes status requests, status updates, and Fire records.

INFO Requirements for WAN are specified in Paragraph 3.3.4 Interface C (WAN).

3.2.5.2 Personal and Near-me Area Network

INFO The Personal and Near-me Area Network (PNAN) is a short range radio network used for communicating Fire records, reports, and associations between different dynamic objects.

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INFO PNAN is also used for reporting to and receiving Status updates from Portable EXCON Equipment.

INFO Requirements for PNAN are specified in Paragraph 3.3.3 Interface B (PNAN).

3.2.6 Exercise control capability

INFO Requirements for exercise control capability are specified in Appendix 4; SSS EXCON.

INFO System Operators will use EXCON to control the status of Dynamic Objects. Status updates include changing simulated damage status, fuel, ammunition, and water supplies etc. as applicable for the respective Dynamic Object.

SS-130. Requirement
Dynamic objects shall be capable of changing its status based on status updates received from EXCON.

3.2.7 Exercise monitoring capability

INFO Requirements for exercise monitoring capability are specified in Appendix 4; SSS EXCON.

SS-131. Requirement (optional)
Players should be able to record video from the Players main observation view (e.g. weapon sight, soldier helmet) and send streamed video as well as and still images to EXCON over WAN. For detailed requirements see the respective Subsystem Specification.

3.2.8 Exercise evaluation capability

INFO Requirements for exercise evaluation capability are specified in Appendix 4; SSS EXCON.

3.3 System external interface requirements

This section describes the requirement on GTETS external interfaces.

SS-132. Requirement
System External Interfaces shall be designed and specified with open and well documented Interface Specification methods allowing and simplifying integration and interoperability with future applications.

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3.3.1 Interface identification and diagrams

INFO The following figure illustrates external and internal interfaces of the GTETS.

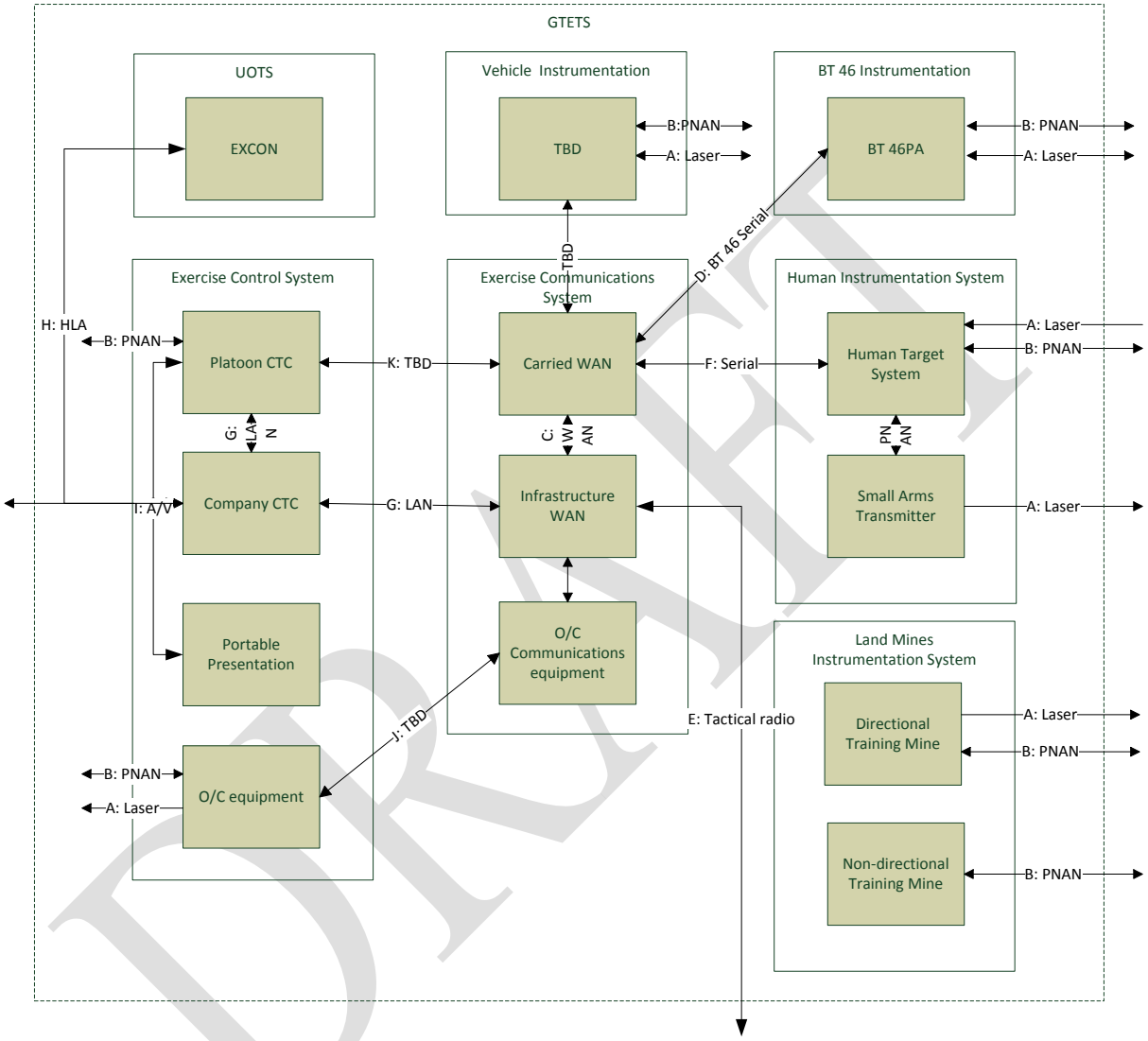

Figure 10: External and internal interfaces of GTETS.

3.3.2 Interface A (Laser)

SS-133. Requirement

Interface A shall provide optical interfaces for OSAG code that is in accordance with OSAG 2.0 Standard [4] and [5].

SS-134. Requirement
When set up for FMV code, Interface A shall provide optical interfaces for FMV code used by the legacy BT 46 system. Refer to [3] for a description of the FMV code and Paragraph 6.2 for an overview of the BT 46 system.

3.3.3 Interface B (PNAN)

SS-135. Requirement
Interface B shall enable wireless communication that is in accordance with WLN specifications [6] and [7].

3.3.4 Interface C (WAN)

INFO The requirements for the Wide Area Network (WAN) are defined in Appendix 3 SSS Exercise Communications system.

3.3.5 Interface D (BT46 Serial)

INFO The BT 46 serial interface connects GTETS WAN-equipment to the BT 46 equipment used by SwAF.

SS-136. Requirement
Interface D shall enable two-way communication with BT 46 equipment. The BT 46 serial interface is described in [3].

3.3.6 Interface E (Tactical radio)

INFO The requirements for the tactical radio interface will are defined in Appendix 3, SSS Exercise Communications system.

3.3.7 Interface F (Serial)

INFO Interface F will provide two-way data communication between carried WAN-equipment and instrumentation systems. Interface F will be defined by requirements in accordance with requirements Appendix 5, SSS Human Instrumentation System.

3.3.8 Interface G (LAN)

INFO This interface will be defined by requirements in SSS EXCON and SSS Exercise Communications system.

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3.3.9 Interface H (HLA)

INFO The purpose of the HLA is to establish a capability for technical and semantic interoperability with a broad spectrum of simulation applications. This interface will also be used to enable exchange of simulation data with external EXCON systems.

SS-137. Requirement
Interface F shall provide HLA connectivity to GTETS that enable training interoperability with external simulators that comply with the following:
a) IEEE 1516 (2010) High Level Architecture [8]
b) RPR FOM v2.0 [9]
c) pRTI 1516 (2010).

3.3.10 Interface I (Audio/video)

INFO GTETS will provide interfaces that enable connection of audio and visual equipment to EXCON for presentation of briefings and AAR. This interface is defined by requirements in SSS EXCON.

3.3.11 Interface J (O/C communication)

INFO GTETS will provide interfaces that enable Instructor/Operator equipment to communicate via carried WAN equipment. This interface is defined by requirements in SSS EXCON and SSS Exercise Communications system.

3.3.12 Additional external interfaces

INFO This Specification defines some critical external interfaces for the purpose of RFQ. Several additional external interfaces will be defined by Contractors when realising the various subsystems of GTETS.

3.4 System internal interface requirements

INFO In this System specification, GTETS system internal interfaces between subsystems are identified. These interfaces are the same as the external system interfaces defined in Section 3.3. At subsystem level, additional external and internal interfaces are identified; refer to the applicable Subsystem Specification for additional requirements.

SS-138. Requirement
All system internal interfaces shall be designed and specified with open and well documented interface specification methods allowing and simplifying integration and interoperability with future applications.

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SS-139. Requirement
All external interfaces of GTETS shall be documented in accordance with requirements Paragraph 3.16.1 Documentation.

3.5 System internal data requirements

SS-140. Requirement
Time used within in GTETS shall automatically be synchronised with GNSS time used in the exercise.

SS-141. Requirement
All time stamps shall be in accordance with GNSS time.

SS-142. Requirement
Each piece of GTETS equipment shall be provided with an internal unique identification code that exhibits the following characteristics:
a) enables unique identification of Targets and weapons
b) not alterable

3.6 electrically readable by external equipment at preventive maintenance Adaptation requirements

INFO Flexibility and adaptability to future needs are important characteristics of the System. This paragraph contains the requirements on adaptation of data and parameters used by the System to the changing operational needs.

SS-143. Requirement
GTETS shall provide the necessary information and tools to enable authorised users to change and add simulation models by the modification of data without the need of programming or compilation of software programs. Data subject to this type of modification include the following:
a) Weapon data
b) Munitions data, ballistics data
c) Vulnerability data
d) Default values

SS-144. Requirement
GTETS shall enable authorised users to change Target template used in Targets.

SS-145. Requirement
GTETS shall enable authorised users to change weapon application used in instrumentation systems.

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SS-146. Requirement
GTETS equipment shall be designed so that the language of the user interface can be changed.

SS-147. Requirement
Swedish and English shall be available for selection as user interface language in all GTETS equipment. Default shall be Swedish language.

3.7 Safety requirements

INFO See the system safety manual H SystSäkE [15] and [16] for further information and requirements on system safety.

3.7.1 Classification and definitions of consequences

SS-148. Requirement
The GTETS safety documentation shall be based on definitions and classification of consequences of accidents for personal health and safety in accordance with Table 1.

Description	Category	Criteria for personnel health and safety
Catastrophic	I	Could result in death.
Critical	II	Serious injury, requires care at least 6 months after the accident
Marginal	III	Less serious injury, no remaining consequences of injury after the medical treatment
Negligible	IV	Negligible injury, care can be carried out at the site, no remaining consequences of injury after the medical treatment.

Table 1: Classification of consequences for personal health and safety

SS-149. Requirement
The GTETS safety documentation shall be based on definitions and classification of consequences of accidents for property in accordance with Table 2.

I	Loss of property, equipment becomes unusable and cannot be repaired.
II	Serious damage to the property, equipment becomes unusable but can be repaired by the contractor.
III	Less serious damage to the property, damaged equipment can be repaired at the unit (a-level).

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IV	Negligible damage, equipment get damaged but operation can continue without interruption. Repair can be done later.

Table 2: Classification of consequences for property

SS-150. Requirement

The GTETS safety documentation shall be based on definitions and classification of consequences of accidents for environment in accordance with Table 3.

I	Serious damage to the environment, it takes at least one year to restore the environment and/or clearing requires.
II	Considerable damage to the environment, recovery within less than one year and/or a smaller clearing requires.
III	Smaller damage to the environment, recovery within less than one month without any actions.
IV	Negligible damage to the environment, negative impact on the environment not violating regulations.

Table 3: Classification of consequences for environmental damage

3.7.2 Classification of frequencies of accidents

SS-151. Requirement

The GTETS safety documentation shall be based on classification of frequencies of accidents in accordance with Table 4.

	Accidents / unit / year	
A	= >$1x10^{-3}$	Will probably occur frequently
B	$1x10^{-3}$ - $1x10^{-4}$	Will occur several times during a lifetime
C	$1x10^{-4}$ - $1x10^{-5}$	Can occur at any time during a lifetime
D	$1x10^{-5}$ - $1x10^{-6}$	Improbable, but possible that an accident will occur during a lifetime
E	= <$1x10^{-6}$	Very improbable that an accident will occur during a lifetime

Table 4: Classification of frequencies

3.7.3 Assessment of risks

INFO Table 5 shows the explanation of definitions in risk matrices.

T	Tolerable risk
LT	Limited tolerable risk, requires decision from FMV about use of additional risk reducing measures
IT	Intolerable risk

Table 5: Explanation of definitions in risk matrix

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SS-152. Requirement

GTETS shall be designed for safe operation and maintenance with maximum tolerable risk levels for personnel hazard events according to the table below.

Consequence		Frequency of occurance				
	Category	A	B	C	D	E
Catastrophic	I	IT	IT	IT	IT	LT
Critical	II	IT	IT	IT	IT	LT
Marginal	III	IT	LT	T	T	T
Remote	IV	IT	T	T	T	T

Table 6: Maximum tolerable risks for personnel.

SS-153. Requirement

GTETS shall be designed for safe operation and maintenance with maximum tolerable risk levels for equipment hazard events according to the table below.

Consequence		Frequency of occurance				
		A	B	C	D	E
Catastrophic	I	IT	IT	IT	IT	LT
Critical	II	IT	IT	IT	LT	T
Marginal	III	IT	LT	T	T	T
Remote	IV	T	T	T	T	T

Table 7: Maximum tolerable risks for equipment.

SS-154. Requirement

GTETS shall be designed for safe operation and maintenance with maximum tolerable risk levels for environment hazard events according to the table below.

Consequence		Frequency of occurance				
		A	B	C	D	E
Catastrophic	I	IT	IT	IT	IT	LT
Critical	II	IT	IT	IT	LT	T
Marginal	III	IT	LT	T	T	T
Remote	IV	T	T	T	T	T

Table 8: Maximum tolerable risks for environment.

SS-155. Requirement

GTETS design shall be in accordance with current Swedish workplace legislation.

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SS-156. **Requirement**
GTETS design shall be in accordance with Swedish environment protection legislation.

SS-157. **Requirement**
GTETS shall not contain chemical materials that are prohibited by FMV, see latest version of [17].

SS-158. **Requirement**
GTETS laser equipment shall be in accordance with Swedish laser class 1.

3.8 Security and privacy requirements

INFO Requirements on security and privacy will be defined by requirements in the respective SSS.

3.9 System environment requirements

INFO This Paragraph defines the environmental conditions that GTETS will encounter in the different modes during its planned life.

INFO In case of deviations between limit values stated in this specification and the verification standard referred to, the values in this specification shall be governing.

3.9.1 Precipitation

SS-159. **Requirement**
GTETS equipment intended for outdoors use shall operate in accordance with this Specification when exposed to precipitation equivalent to rainfall of 40 mm/h.

3.9.2 Temperature

SS-160. **Requirement**
GTETS equipment intended for use outdoors and in non-heated indoor environment shall operate in accordance with this Specification when exposed to ambient temperatures ranging from -25°C to 40°C.

SS-161. **Requirement**
GTETS equipment intended for use inside buildings and equivalent environment shall operate in accordance with this Specification when exposed to ambient temperatures ranging from 10°C to 30°C.

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SS-162. Requirement
GTETS equipment shall operate in accordance with this Specification after being exposed to ambient temperatures between -40°C to 55°C during transportation and storage.

3.9.3 Humidity

SS-163. Requirement
GTETS equipment intended for use outdoors and in non-heated indoor environment shall operate in accordance with this Specification when exposed to ambient relative humidity ranging from 10% to 95 %.

SS-164. Requirement
GTETS equipment intended for use inside buildings and equivalent environments shall operate in accordance with this Specification when exposed to ambient relative humidity ranging from 30 % to 70 %.

SS-165. Requirement
GTETS equipment shall operate in accordance with this Specification after being exposed to an ambient relative humidity ranging from 5% to 95% during transportation and storage.

3.9.4 Atmospheric pressure

SS-166. Requirement
GTETS equipment shall operate according to this Specification at altitudes ranging from 0 m to 1000 m.

SS-167. Requirement
GTETS equipment shall operate in accordance with this Specification after being exposed to pressure change according to MIL-STD 810F:500.4 [14] or equivalent during transportation.

3.9.5 Vibration and shock

INFO Equipment used or transported in air, land, and sea vehicles will be exposed to considerable shock and vibration.

SS-168. Requirement
GTETS equipment shall operate in accordance with this Specification after being exposed to vibration according to MIL-STD 810F [14] 514.5 and 516.5 Procedure I, IV during operation.

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SS-169. Requirement
GTETS equipment shall be designed for air, ground, and sea commercial transportation without being damaged by vibration and shock due to movement, handling in transit, hoisting, and tie-down aboard transporting vehicles during transportation.

3.9.6 Electromagnetic compatibility

SS-170. Requirement
GTETS equipment shall be electromagnetically compatible within the GTETS system.

SS-171. Requirement
GTETS equipment shall be electromagnetically compatible with the actual combat equipment (i.e. communications systems, electronics, and other electrical systems) in use by the training unit.

SS-172. Requirement
The electromagnetic compatibility of equipment in server rooms and Buildings shall be in accordance with requirements in the latest established issue of the following standards or better:

a) EN 61 000-6-2, Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments [11].
b) EN 61 000-6-3, Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments [12].

SS-173. Requirement
GTETS equipment shall be designed to minimize electromagnetic conduction according to MIL-STD-461E [13] method CE01, CE03, CE04 and CE05.

SS-174. Requirement
GTETS equipment shall be designed to minimize electromagnetic radiation according to MIL-STD-461E [13] method CE01, CE03, CE04 and CE05.

SS-175. Requirement
GTETS be designed to protect instrumentation equipment from electrical transients from external equipment.

SS-176. Requirement (optional)
GTETS equipment should be able to operate during electronic warfare training where the tactical equipment of the training units is subject to jamming.

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3.9.7 Dust

SS-177. Requirement
GTETS equipment for use in an outdoors environment shall be protected against intrusion from, tested according to IEC60529 [10], class IP 5X or equivalent.

3.9.8 Immersion

SS-178. Requirement
GTETS equipment for use in an outdoors environment shall resist ingress of water to an extent equivalent to IP code X5 according to IEC 60529 [10].

SS-179. Requirement (optional)
GTETS components for use in an outdoors environment should resist ingress of water to an extent equivalent to IP code X7 according to IEC 60529 [10].

3.10 Computer resource requirements

3.10.1 Computer hardware requirements

SS-180. Requirement
Computer hardware, electronics equipment within GTETS shall, where possible, be non-development items which are commonly available on the consumer market and which can be shown to have a broad user base.

SS-181. Requirement
GTETS shall be designed to minimise the number of different computers and components so that a single same hardware configuration is used within groups of computers and other equipment with similar performance requirements.

3.10.2 Computer hardware resource utilization requirements

SS-182. Requirement
All embedded computer hardware in GTETS instrumentation equipment shall be prepared for additional memory that enable future addition of functionality.

3.10.3 Computer software requirements

SS-183. Requirement
Third party computer software, such as applications, operating systems, and device drivers that are part of the GTETS shall be non-development items which are commonly available on the consumer market and which can be shown to have a broad user base and be supported by their respective vendors.

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3.11 System quality factors

INFO This paragraph defines the requirements pertaining to GTETS quality factors.

INFO Prerequisites for each maintenance level and their associated tasks to be performed are stated in the table found in the OCD [2].

3.11.1 Reliability, Maintainability, and Availability

INFO Additional requirements are defined in the respective subsystem specification.

INFO The support concept for GTETS equipment is defined in Paragraph 5.5 of the OCD [2].

3.11.1.1 Preventive maintenance

INFO Requirements on main inspection (Sw: Grundtillsyn) are defined in the respective subsystem specification.

SS-184. Requirement
Daily inspection assigned to Trainees shall not take more than 2 minutes in average to complete.

SS-185. Requirement
Daily inspection assigned to System Operators shall not take more than 10 minutes in average to complete.

SS-186. Requirement
Special inspection shall not take more than 10 minutes in average to complete.

3.11.1.2 Corrective maintenance

SS-187. Requirement
GTETS equipment shall be designed for repair through the replacement of line replacement units.

SS-188. Requirement
GTETS shall provide the support and test equipment, which is not provided by the standard inventory of SwAF that enable performance checks, safety checks and maintenance at A- and B-level (see OCD for description of maintenance at A- and B-level).

SS-189. Requirement
Mean-time to repair (MTTR) shall be less than 20 minutes.

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SS-190. Requirement (optional)
Mean-time to repair (MTTR) should be less than 10 minutes.

SS-191. Requirement
At least 80% of failures shall be possible to repair within 60 minutes at B-level.

3.11.1.3 Availability

SS-192. Requirement
The operational availability of GTETS shall exceed 90% when used according to the operational profile.

SS-193. Requirement (optional)
The operational availability of GTETS should exceed 95% when used according to the operational profile.

SS-194. Requirement
The time needed to prepare GTETS for an exercise shall not exceed 10% of planned time for the exercise.

SS-195. Requirement (optional)
The time needed to prepare GTETS for an exercise should not exceed 5% of planned time for exercise.

3.11.2 Testability

SS-196. Requirement
GTETS equipment shall provide BIT that automatically monitors the operational status of the equipment.

SS-197. Requirement
BIT shall report results
a) when the equipment starts up,
b) when detecting malfunction,
c) at the command of the user,
d) when prompted by EXCON.

SS-198. Requirement
The result of the BIT shall be presented to the user.

SS-199. Requirement
BIT shall be capable of identifying faulty LRU.

SS-200. Requirement
BIT results shall be reported to EXCON.

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SS-201. **Requirement**
Diagnostics initiated from EXCON shall determine the operational readiness of the functions in the system.

SS-202. **Requirement**
In TACTICAL TRAINING MODE, GTETS shall enable operators to fire towards Targets for the purpose of testing the laser engagement simulation function, while neither affecting the Targets status nor the simulated weapon ammunition supply.

SS-203. **Requirement (optional)**
GTETS should be designed so that diagnosis and fault localisation can be conducted via network connection from a remote site.

3.12 Design and construction constraints

INFO This paragraph specifies requirements that constrain the design and construction of GTETS, and which are the result of design decisions made by FMV. It also contains requirements pertaining to the architecture of the System. GTETS will be subject to modification, alteration, and expansion during the life cycle and thus, there is a need for the System to be flexible and allow easy insertion of new functions.

3.12.1 Architecture requirements

INFO No requirements identified.

3.12.2 Design standards

INFO No requirements identified.

3.12.3 Physical characteristics

SS-204. **Requirement**
Instrumenting objects with GTETS equipment shall not require permanent modification or alterations of the equipment that is instrumented.

SS-205. **Requirement**
Instrumenting objects with GTETS equipment shall not affect the audio, visual, infrared, near infrared, and radar signature of the instrumented object to an extent that introduces negative training.

SS-206. **Requirement**
GTETS instrumentation equipment shall be compatible with the operational equipment so that the intended use, including carrying, movement, operation and handling, of equipment is not impaired.

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SS-207. Requirement
GTETS shall not interfere with, or in any way disturb the tactical use of sensors in the exercise, including:
a) Night vision devices
b) Infrared sensors

SS-208. Requirement
GTETS shall not interfere with, or in any way disturb tactical radios and other operational communications equipment used in the exercise.

SS-209. Requirement
System equipment, components, and parts shall by their part number be completely identified as to form, fit and function.

SS-210. Requirement
System equipment, components, and parts with the same part number shall be identical and interchangeable with each other.

SS-211. Requirement
GTETS shall be designed so that operational laser range finders of the training unit that are not allowed for use during exercise can be replaced with range finding with GTETS laser components.

SS-212. Requirement
GTETS shall be designed to allow fast and safe restoration of instrumented vehicles, equipment and objects to operational mode.

SS-213. Requirement
Radio equipment within the GTETS shall operate in any of the following frequency bands:
a) Non-regulated civilian frequency bands (WLAN, Bluetooth, etc.)
b) Civilian frequency bands allocated to the SwAF, currently 68-88 MHz, 138-174 MHz, and 400-470 MHz
c) Frequency band approved by the Swedish Post and Telecom Authority.

SS-214. Requirement
The bandwidth per radio channel used by the GTETS shall be maximum 25 KHz when using the civilian frequency bands allocated to the SwAF.

3.12.4 Materials

INFO See the respective subsystem specification for applicable requirements.

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SS-215. Requirement
GTETS components for use in an outdoors environment shall be corrosion-resistant.

3.12.5 Flexibility and expandability

SS-216. Requirement
GTETS shall be designed in a modular fashion that allows modification, upgrade, and replacement of major functional elements (‘subsystems’) as independent self-contained combinations of hardware and software.

SS-217. Requirement
GTETS shall be designed so that new variants of existing applications can be added to the system with a minimum of development work.

SS-218. Requirement
Major equipment and components of instrumentation systems shall be designed as general purpose components that enable reuse for a wide range of applications with a minimum of adaptation.

3.12.6 External power supply

SS-219. Requirement
GTETS equipment intended for use under stationary circumstances shall provide the capability to operate on 230 or 400 VAC +/- 10%, 50 Hz +/- 20 % external power.

SS-220. Requirement
GTETS shall, when available on the instrumented object, primarily use the power supply of the instrumented object. Available power supply will be different for each application but voltage will be within the range of 10-48 VDC.

SS-221. Requirement
GTETS equipment using external power supply from instrumented objects shall be designed so that temporary high effect consumption in the power system of the instrumented object does not negatively affect the function of the GTETS equipment.

3.12.7 Battery performance

SS-222. Requirement
GTETS shall enable at least 5 days of continuous exercise without the need to replace or recharge batteries.

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SS-223. Requirement (optional)
GTETS equipment should be capable of at least 10 days of continuous exercise without the need to replace or recharge batteries.

SS-224. Requirement
Batteries used for power supply of GTETS equipment shall be commercially available standard batteries as far as technically feasible.

SS-225. Requirement (optional)
Batteries used for power supply of GTETS equipment should be batteries with a broad use within the Swedish Armed Forces.

SS-226. Requirement
Battery powered GTETS equipment shall be designed for operation using rechargeable batteries.

SS-227. Requirement (optional)
Battery powered GTETS equipment should be designed to enable operation using disposable batteries.

SS-228. Requirement
Battery powered GTETS equipment shall indicate low battery status to the operator.

SS-229. Requirement (optional)
Battery powered GTETS equipment should report low battery status via the reporting function.

SS-230. Requirement (optional)
Battery powered GTETS equipment should provide the capability to present the current battery status to the operator.

SS-231. Requirement
GTETS equipment shall be designed so that batteries intended to be replaced in the field take no more than one (1) minute to replace.

SS-232. Requirement
GTETS equipment shall be designed so that battery can be replaced without any loss of data.

SS-233. Requirement
Battery powered GTETS equipment shall, automatically and within 30 seconds after replacing battery, establish associations to equipment that existed before the battery was replaced.

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3.12.8 Marking

INFO This paragraph defines the requirements on identification marking of equipment, parts and transportation equipment for the components of GTETS.

SS-234. Requirement
The unique identification code defined in SS-142 shall be visible from outside of the equipment.

SS-235. Requirement
Equipment and components within GTETS shall be marked with Swedish national stock number (FBET), item name (FBEN) and serial part number (IND) by using bar code signs Type 222 according to FSD 0246E [19] suitably placed for easy reading and changes.

Figure 11: Example of bar code sign type 222.

SS-236. Requirement
Transport and storage containers shall be marked on one short side and on the upper side with storage designation, storage denomination and package weight in accordance with the Swedish Armed Forces guidelines for marking [20].

SS-237. Requirement
Wires and cables shall be marked at all ends and allow identification in the corresponding product documentation.

SS-238. Requirement
Cables shall be marked with Swedish national stock number (FBET) and provide identification of connections at all ends.

SS-239. Requirement
Ammunition shall be marked according to current regulations for marking of ammunition.

3.12.9 Other design and construction requirements

SS-240. Requirement
GTETS shall be designed to minimise the risk of Players tampering with equipment to affect the outcome of engagement simulation. In case Players tamper with GTETS instrumentation to interfere with normal operation during training, including tampering with power supply, cabling, detectors, transmitters, etc, GTETS shall detect the tampering and disable the engagement capability of the Player.

3.13 Personnel-related requirements

INFO This paragraph defines the system requirements related to the personnel who will use and support the system.

INFO See Operational Concepts Description [2] for definition of user roles.

3.13.1 Error prevention

SS-241. Requirement
GTETS shall be designed to prevent errors caused by user interactions, including:
a) prevention of errors due to entry or loading of unexpected data
b) provision of information to users about when a specific format or type of data is expected
c) provision of feedback to users when unexpected data is entered or loaded

3.13.2 Error and status messages

SS-242. Requirement
Error and status messages presented by GTETS to users shall exhibit the following characteristics:
a) expressing the problem or status in plain language (no codes)
b) precisely indicating the problem or status
c) constructively suggesting a solution to problems

3.13.3 Ergonomics

SS-243. Requirement
Display screens in GTETS for indoor use shall exhibit adjustable contrast and luminance characteristics that allow them to be used in both normal ambient office illumination and dampened illumination.

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SS-244. Requirement
Display screens in GTETS for outdoor use shall exhibit adjustable contrast and luminance characteristics that allow them to be used in daylight and darkness.

SS-245. Requirement
The graphical user interface of workstations shall exhibit the following characteristics:
a) consistent design regarding the use of words, meaning of situations and actions
b) be in accordance with graphical user interface standards of the desktop environment

SS-246. Requirement
GTETS shall provide feedback to users about the changes in the status of equipment

SS-247. Requirement
GTETS shall provide feedback to users about progress during waiting times that are caused by GTETS.

SS-248. Requirement
GTETS shall be designed to minimise system response times and inconveniences to operators caused by delays.

3.14 Training-related requirements

3.14.1 Training prerequisites

INFO The target audience for operator training will have basic knowledge on operational equipment that is relevant for the training.

INFO The target audience for maintenance training will have a basic technical competence.

INFO Refer to the Operational Concept Description [2] for a description of target audience.

3.14.2 Operator training

SS-249. Requirement
GTETS shall be designed so that Trainees, with the help of the applicable user manual, are able to prepare for, participate in GTETS training, and conduct daily maintenance after maximum 30 minutes of GTETS specific training.

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SS-250. **Requirement**
GTETS shall be designed so that Observer/Controllers, with the help of the applicable user manuals, are able to use O/C equipment and portable EXCON equipment for conducting and monitoring GTETS training after maximum 8 hours of GTETS specific training.

SS-251. **Requirement**
GTETS shall be designed so that System Operators, with the help of the applicable user manuals, are able to use the full potential of GTETS after maximum 40 hours of GTETS specific training.

3.14.3 Maintenance Training

SS-252. **Requirement**
GTETS shall be designed so that System Operators, with the help of the applicable user manuals, are able to conduct special maintenance on GTETS after 8 hours of GTETS specific Training.

SS-253. **Requirement**
GTETS shall be designed so that System Technicians, with the help of the applicable repair manuals, are able to conduct basic preventive maintenance of GTETS after 16 hours of GTETS specific Training.

SS-254. **Requirement**
GTETS shall be designed so that System Technicians, with the help of the applicable repair manuals, are able to perform corrective maintenance of GTETS after 40 hours of GTETS specific training.

SS-255. **Requirement**
GTETS shall be designed so that System Technicians, with the help of the applicable repair manuals, are able to prepare GTETS equipment for long term storage after 40 hours of GTETS specific training.

3.15 Logistics-related requirements

3.15.1 Operational life

INFO The planned life of the System is 30 years. FMV intends to make no changes to the hardware and software configuration of the System for periods of 3-5 years. System wide replacement of COTS computers and other commercially available components, major overhaul of hardware, etc will be done with a minimum interval of 5 years.

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SS-256. Requirement
The technical life of custom made components in GTETS shall be at least 15 years.

SS-257. Requirement
The technical life of commercially available components in GTETS shall be at least 5 years.

3.15.2 Operational profile

INFO The operational profile for the equipment each year will be in accordance with the following:

a) Two (2) exercises, each for the duration of 14 days
b) Six (6) exercises, each for the duration of 7 days
c) Fifteen (15) exercises, each for the duration of up to 5 days

INFO Each exercise includes the following activities:
a) Transit from storage area to training area
b) Mounting of instrumentation equipment (once)
c) Training (preparation, execution, evaluation)
d) Demounting of instrumentation equipment (once)
e) Restoration and preventive maintenance
f) Transit from training area to storage area

SS-258. Requirement
GTETS equipment shall be designed for at least 800 hours of operation per year.

SS-259. Requirement (optional)
GTETS equipment should be designed for at least 1600 hours of operation per year.

SS-260. Requirement
GTETS equipment shall be designed for at least 300 exercises during a 15 year period.

SS-261. Requirement (optional)
GTETS equipment should be designed for at least 600 exercises during a 15 year period.

SS-262. Requirement
All equipment within GTETS shall automatically keep track of its own total accumulated operating time.

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SS-263. Requirement
All equipment within GTETS shall be able to report the accumulated operating time to system operators and System Technicians when performing maintenance actions, where it is applicable.

SS-264. Requirement
All equipment within GTETS that is capable of simulated fire shall automatically keep track of accumulated number of fired rounds/shots.

SS-265. Requirement
All equipment within GTETS shall be able to report the accumulated number of fired rounds/shots to System operators and System Technicians when performing maintenance actions, where it is applicable.

3.15.3 Storage and transportation

SS-266. Requirement
GTETS equipment shall be designed for deployment to training areas, and thus not require fixed installation of infrastructure.

SS-267. Requirement
GTETS equipment shall be designed so that two (2) System Operators can prepare GTETS equipment for one (1) Company size exercise for transportation within 4 hours.

SS-268. Requirement
GTETS equipment shall be compatible with Swedish Armed Forces logistics system for transportation by road, rail, sea and air.

SS-269. Requirement
GTETS equipment shall be possible to transport by means of commercial cargo transportation by road, rail, sea and air.

SS-270. Requirement
GTETS shall provide containers for storage and transportation of all GTETS equipment and accessories.

SS-271. Requirement
Containers for storage and transportation shall be designed for stacking on top of each other.

SS-272. Requirement
Containers for storage and transportation shall be equipped with carrying handles.

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SS-273. Requirement (optional)
Containers for storage and transportation should be possible to be connected to dry air supply.

SS-274. Requirement (optional)
Containers for storage and transportation should be lockable.

SS-275. Requirement (optional)
Storage containers should be designed to allow maintenance actions, e.g. charging batteries, changing configuration etc. while in storage.

3.16 Other requirements

3.16.1 Documentation

INFO The documentation shall be designed, in terms of content, to meet the need for users and technicians to manage the system and also find information on how to handle malfunctions and, when possible, make repair on units included in the Human instrumentation system.

SS-276. Requirement
GTETS shall provide technical information for operation and maintenance of GTETS in the form of electronic and paper publications that are in accordance with ‘FMV Handbok materielpublikationer’ [20], with specific reference to paragraphs as follows:
a) Common requirements, see Part 3B, Paragraph 2
b) User manual (Swedish: IBOK), see Part 3, Section 16, Paragraph 4.6
c) Repair manual (Swedish: RBOK), see Part 3B, Paragraph 4.7
d) Maintenance schedules (Swedish: MTRLVSCH), see Part 3B, Paragraph 4.2.1, 4.2.2 and 4.2.3

SS-277. Requirement
GTETS shall provide technical information about materiel that is in accordance with ‘Handbok materielförteckningar’ [21] including
a) Illustrated spare parts catalogue (Swedish: RDKAT), see Section 14
b) Inventory lists (Swedish: Sats- och tillbehörslistor)

SS-278. Requirement
GTETS shall provide technical information necessary for operation, maintenance, modification, and disposal, including the following
a) Configuration specifications for all computer hardware and software configuration items.
b) Production drawings for all equipment, components, parts, etc. that are unique to GTETS

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c) Product data structure allowing storage designation and denomination (M/F number) classification according to Swedish Armed Forces codification standards.
d) Installation documentation according to ’Projekterings och installationsanvisningar för teleanläggningar’[22]
e) Installation instructions
f) Interface requirement specifications and complete interface design descriptions for all external interfaces
g) Interface requirement specifications and complete interface design descriptions for all internal interfaces between major components

SS-279. Requirement
GTETS shall provide maintenance instructions that enable personnel at C-level to perform maintenance tasks as defined in the OCD.

SS-280. Requirement
The maintenance instructions for C-level maintenance shall at least contain the following information:
a) Overall description of the system
b) The basics for maintenance and fault tracing
c) Installation and un-installation of software modules
d) Mounting and dismounting instructions of hardware sub units, including placement of cable inlets/outlets
e) Test instructions to verify the installation
f) Fault tracing, including methods, indications, actions, etc.
g) Regular maintenance actions during operation and storage.
h) Necessary instruments, test tools and test programs, etc.
i) Safety instructions
j) Repair instructions
k) Support for training of maintenance personnel
l) Processes and procedures to safeguard IT-security

SS-281. Requirement
Publications for use and maintenance of GTETS shall be provided in Swedish language.

SS-282. Requirement
Technical data package and instructions for C-level maintenance shall be provided in Swedish or English language.

SS-283. Requirement
All units of measurements shall be in accordance with the international SI system.

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SS-284. Requirement
All documentation shall be delivered in an electronic format that allows editing.

3.17 Packaging requirements

INFO No requirements defined. See for requirements on transportation containers and related requirements.

3.18 Precedence and criticality of requirements

See other Requirement.

4 Qualification provisions

SS-285. Requirement
The verification method used for the verification of each requirement in this Specification shall be one or more of the following:

a) Test (formal) is the verification that a specification requirement has been met by measuring, recording, or evaluating qualitative and quantitative data obtained during controlled exercises under all appropriate conditions using real and/or simulated stimulus.
b) Demonstration is the functional verification that a requirement is met by observing the qualitative results of operation or exercise performed under realistic operational conditions by Swedish Armed Forces personnel.
c) Analysis is the verification by evaluation or simulation using mathematical representations, charts, graphs, circuit diagrams, calculation, or data reduction. This includes analysis of algorithms independent of computer implementation, analytical conclusions drawn from test data, and extension of test-produced data to untested conditions.
d) Inspection is the verification by physical and visual examinations of the item, reviewing descriptive documentation, and comparing the appropriate characteristics with all the referenced standards to determine compliance with the requirements. Examples include verification of physical fidelity of operator stations by comparing with the actual equipment
e) Certificate of Compliance is a means of verifying compliance for items that are standard products. Signed certificates from vendors state that items meet procurement specifications, standards, and other requirements as defined in the purchase order. Records of tests performed to verify specifications are retained by the vendor as evidence that the requirements were met and are made available by the vendor for purchaser review.

INFO A verification matrix template is provided in Appendix 2 to this Specification to be completed by the Contractor and approved by FMV. Verification of requirement conformance will require successful test or demonstration of system capability

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during operation performed by Swedish Armed Forces personnel under realistic conditions in the operating environment unless otherwise stated by FMV.

5 Requirements traceability

INFO Not applicable to this System Specification.

6 Notes

6.1 Definitions and acronyms and abbreviations

INFO See Appendix 1, Acronyms and definitions.

6.2 Overview of the BT 46 laser simulator system

INFO The BT 46 is a two-way laser Engagement simulator system used for high precision firing and target simulation and evaluation. The simulation units for this interface are described below.

6.2.1 Description BT 46G

INFO The BT46G is a two way laser system that uses Swedish class 1 laser to measure the distance, vertical- and horizontal position of a reflecting target.

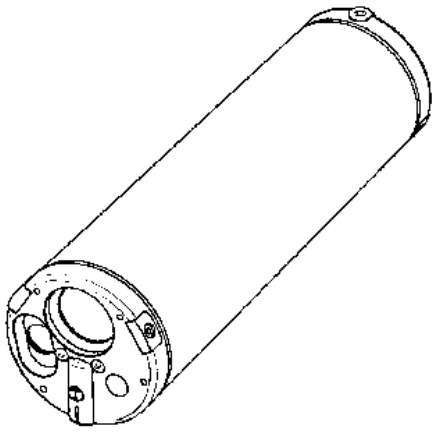

Figure 12. BT46G two way laser firing simulator unit.

INFO The target instruments must be equipped with prism that reflects the laser light back to the firing simulation system and detectors that can receive hit information from the laser. When the BT46G is searching for reflecting targets it sends what is

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called null information. Null information consists of short pulses with the wave length of 900 nanometers for 60 nanoseconds and 150 microseconds between each null information, see Figure 13. Laser pulses sent from BT46G.

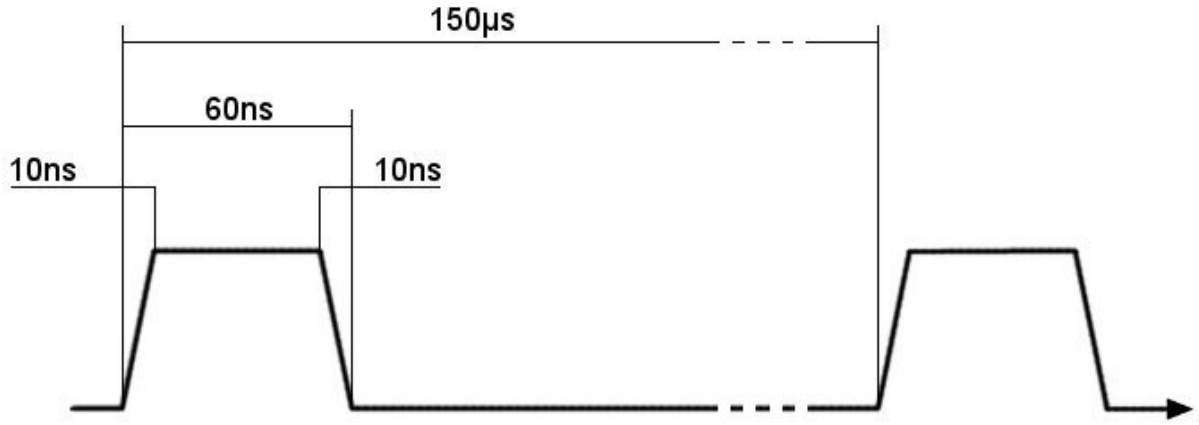


Figure 13. Laser pulses sent from BT46G.

6.2.2 Description BT46T

INFO Vehicles with the BT46 instrumentation are equipped with the BT46T unit for target simulation. The BT46T unit has four reference modules with prisms that reflects the laser pulses sent by the BT46G two way laser units. Each reference module has two laser detectors to receive the laser codes sent by the BT46G and the SKJUTSIM EHV units.

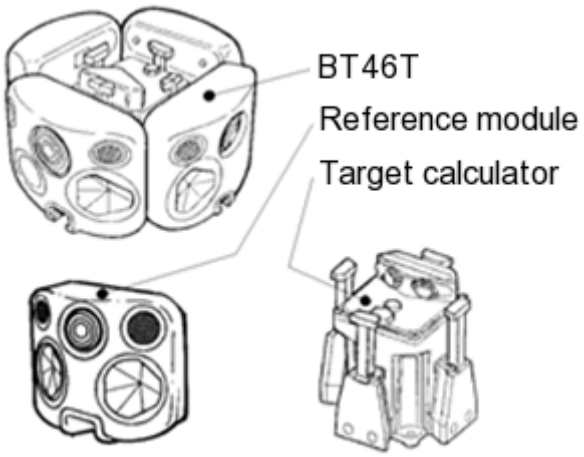


Figure 14. BT46T target simulation instrumentation.

INFO The two detectors on the reference module each have a vertical visual field of 45 degree and a horizontal visual field of 60 degree, which means that the detectors' visual fields overlap.

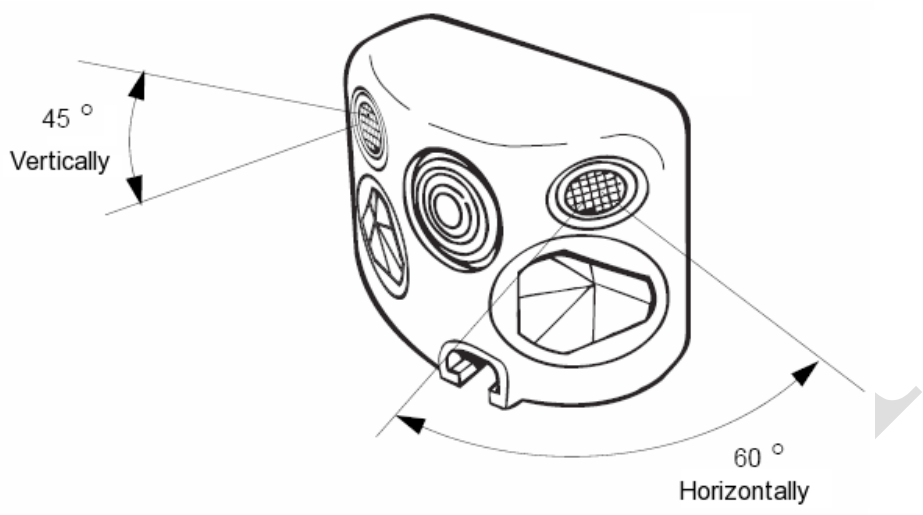


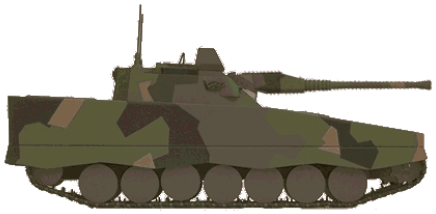
Figure 15. BT46 reference module.

INFO The detectors have a lens that concentrates the laser light against a photodiode. The diode has a maximum sensitivity at the same wave length that the BT46G firing simulation unit uses (900 nm).

6.3 List of vehicles and vessels

INFO List of vehicles that will be used within GTETS.

Vehicle / Vessel, Swedish acronym	**Type**	**Picture**
Strv122	MBT	
Bgbv120	ARV	

Ingbv120	AEV	
Strf9040A/B	CV	
Strf9040C	CV	
Strf Lvkv90	AAV	
Bgbv90	ARV	
E/Stri90	CPV	
PBV302	APC	

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Patgb203	AWV	
Patgb360	AWV	
Tgb11	ATV	
Tgb13	ATV	
Tgb21	ATV	
Pvrbbv2062	ATTV	
Patgb6	ATV	

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Bv309	ATTV	
Ptgb4 GW	ATV	
Ptgb4 LC	ATV	
Ptgb5 Sprint	Utility vehicle	
Strib90H	Combat craft	

Table 9, List of Vehicles and vessels

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